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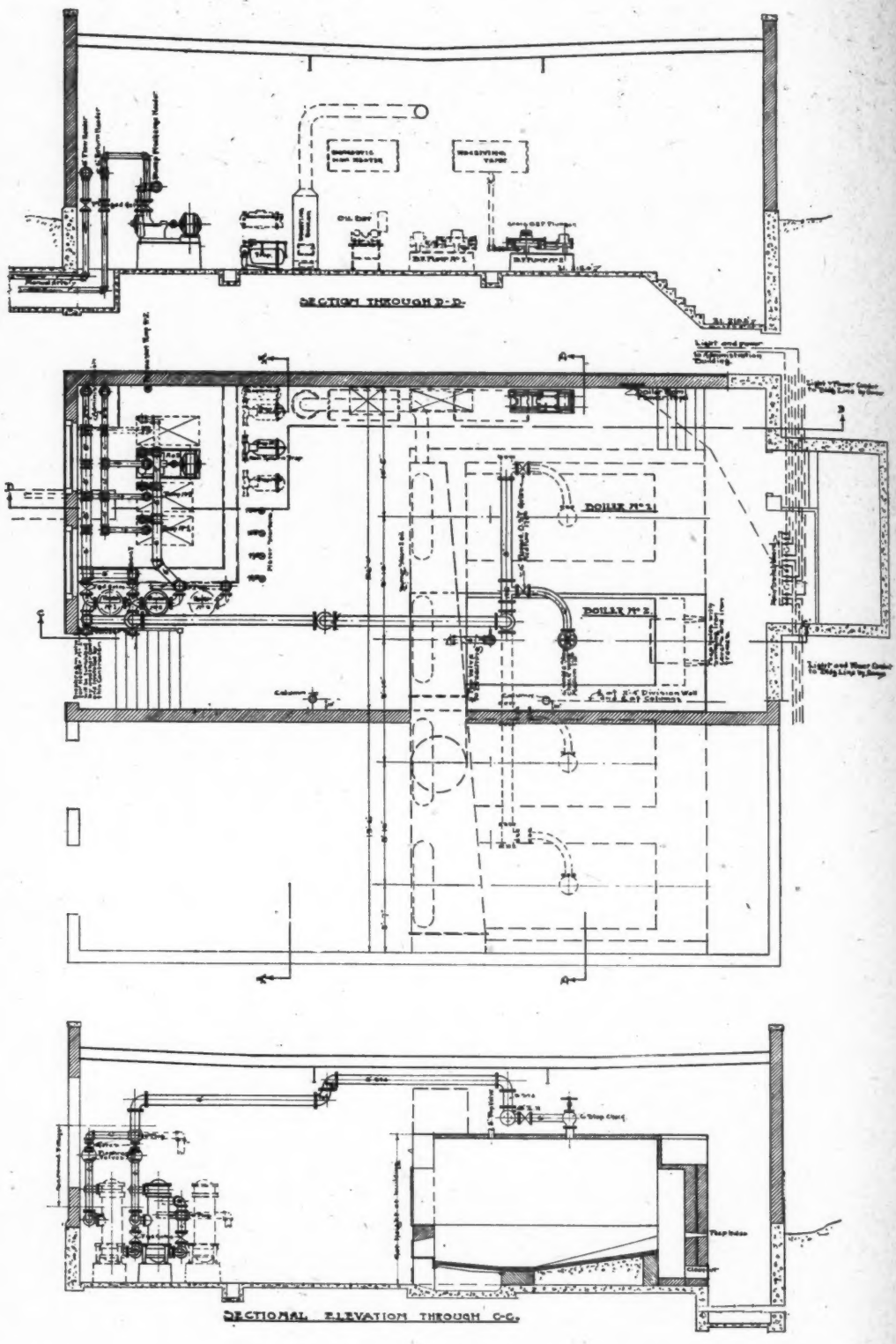
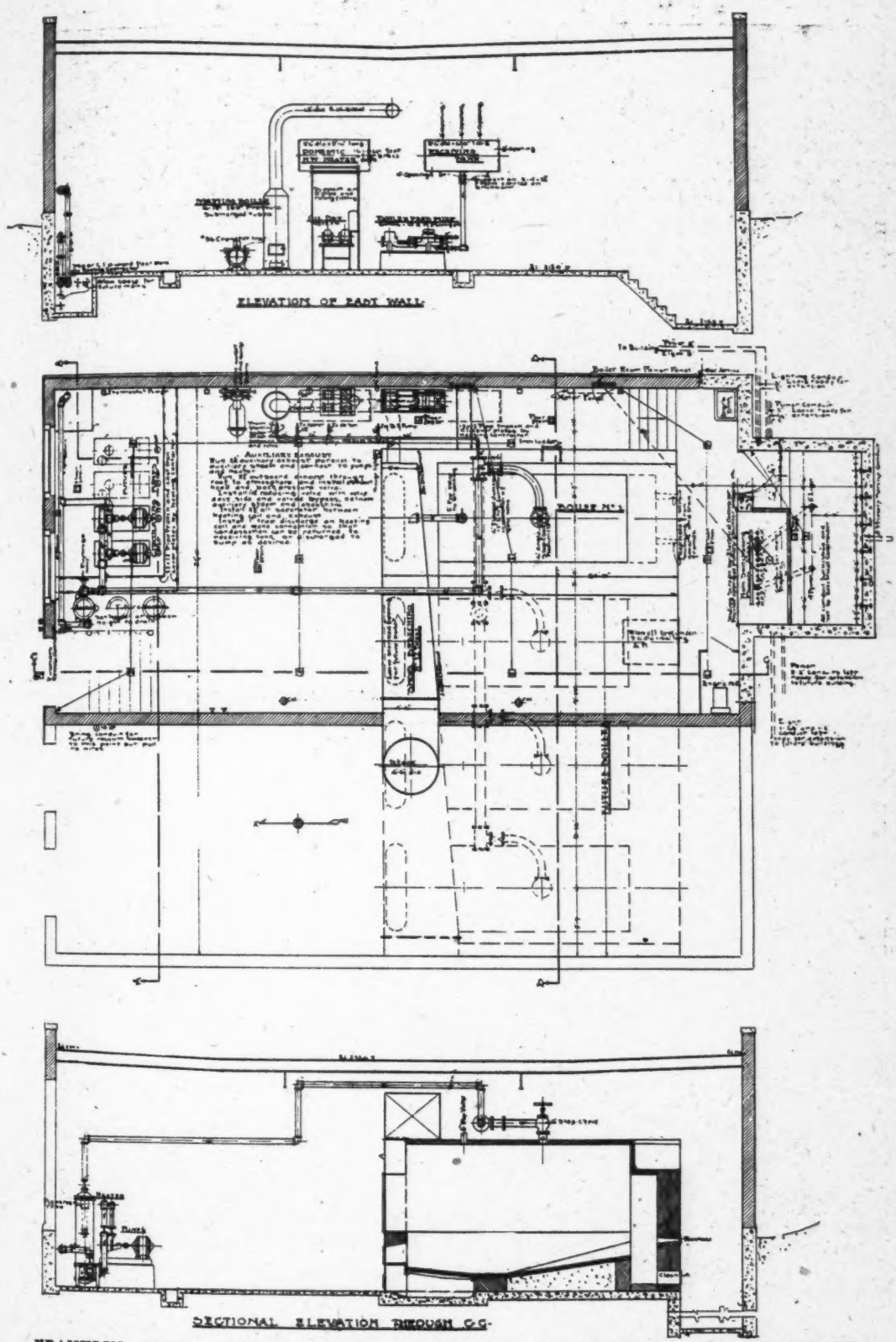
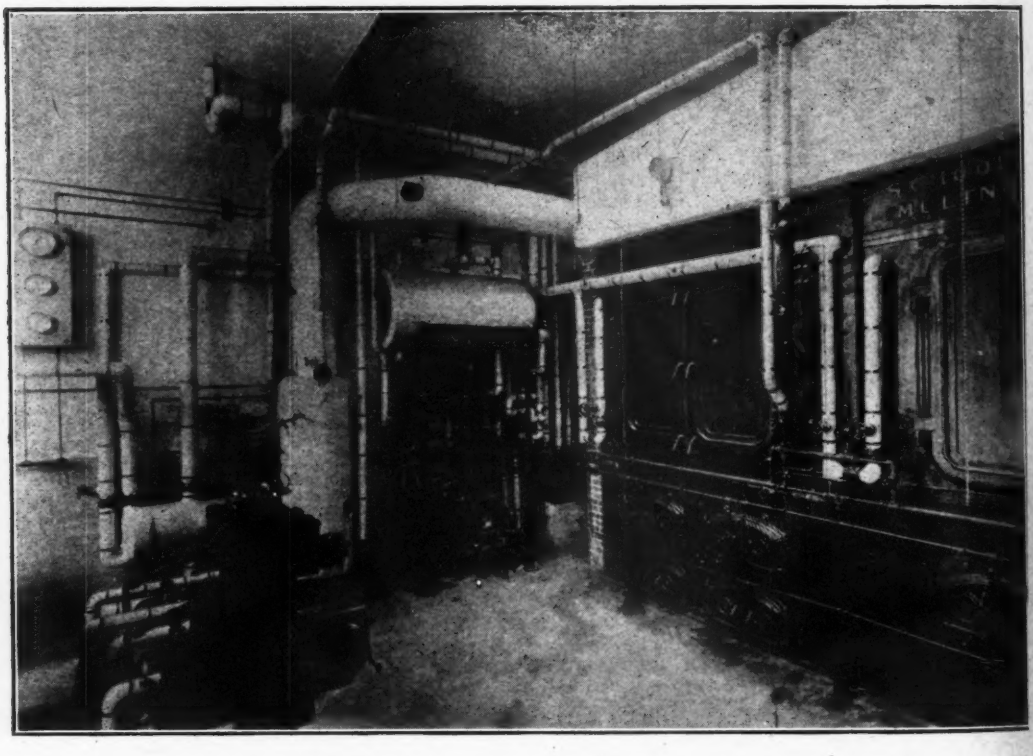


FRANKLIN HIGH SCHOOL—BOILER HOUSE AND ARRANGEMENT OF PERMANENT PIPING AS INSTALLED WITH SECOND UNIT.



FRANKLIN HIGH SCHOOL—BOILER HOUSE AND ARRANGEMENT OF TEMPORARY STEAM AND HOT WATER HEATING PIPING.

CIRCULATING PUMPS AND HEATERS, FRANKLIN HIGH SCHOOL.



BOILER ROOM, SHOWING OIL PIPING, FRANKLIN HIGH SCHOOL.

PRELIMINARY CALCULATIONS.

The area of the building on the ground is multiplied by the distance from the lowest floor to the highest ceiling, and the contents thus obtained multiplied by an air change depending upon the known use of the building. In the case of this school the estimates of the several buildings were found as follows:

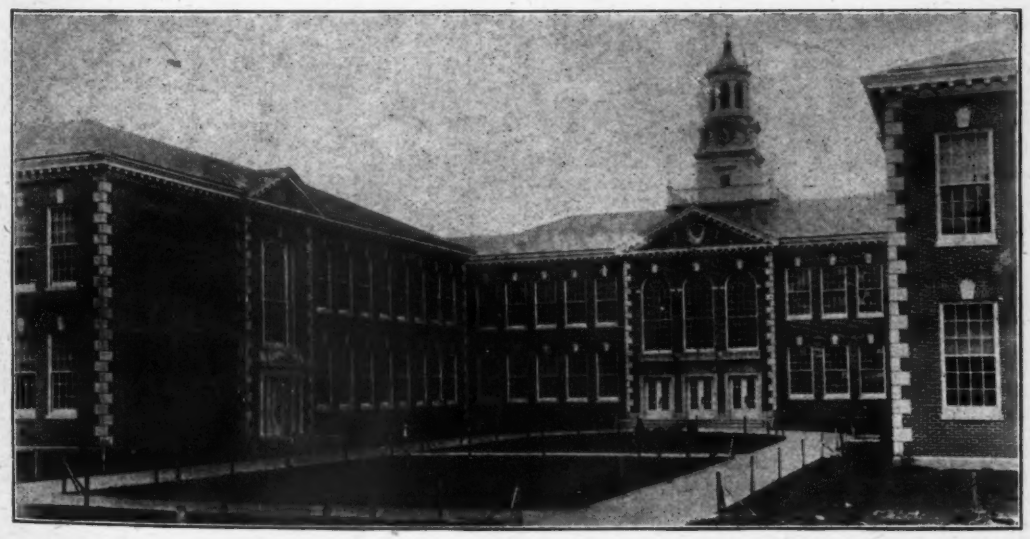
All the buildings are designed to heat from 5° F. to 68° F. and 100° at the coils has been found sufficient for the regular classroom work. An exception to this is the Auditorium where the final temperature is taken as 75°. In the required load 5% is added to take care of the miscellaneous losses. A factor was found $(60 \times r \times 105 \div 55)$ which, multiplied into the air delivery to the various buildings gave the estimated B. T. U. requirements.

CUBIC CONTENTS.

Building.	Area, Sq. Ft.	Height, Ft.	Contents, Cu. Ft.
Administration	29,000	27½	800,000
Physics	16,100	27½	443,000
Manual Arts	16,100	27½	443,000
Gymnasium	13,650	27½	550 000
Auditorium, (Caféteria)	13,650	13	177,000

AIR SUPPLIES.

Building.	Contents, Cu. Ft.	Air Change Per Hr.	Air Supply, C. F. M.
Administration	800 000	5½	73,400
Physics	443 000	5½	40,000
Manual Arts	443 000	5½	40,000
Gymnasium	550 000	4	37 000
Auditorium:			
1800 seats @ 25 C. F. M.		45,000	
Caféteria, 177,000 cu. ft.		16,000	
Six class-rooms @ 1600 C. F. M. each		9,600	70,600



SOUTH VIEW OF MAIN BUILDING, FRANKLIN HIGH SCHOOL.

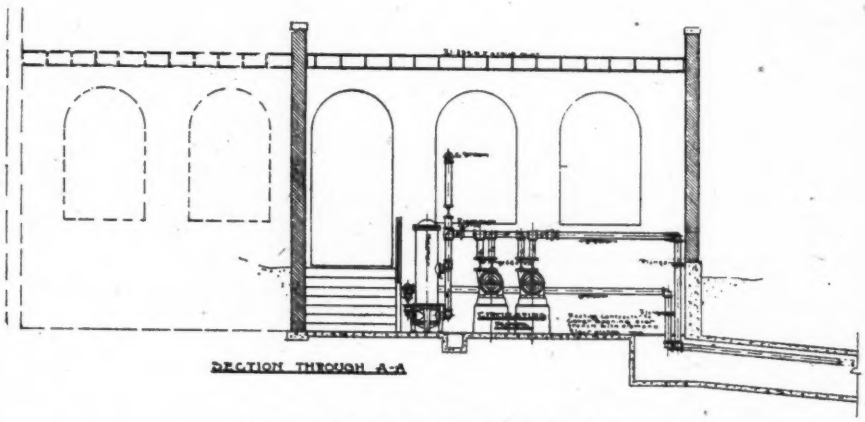
HEATING LOADS.

Building.	Air Delivery.		Factor.	B. T. U. Required.
Adminstration	73,400	x	110	8,050,000
Physics	40,000	x	110	4,400,000
Manual Arts	40,000	x	110	4,400,000
Gymnasium	37,000	x	110	4,100,000
Auditorium	45,000	x	80	
Caféteria and classrooms	26,000	x	110	6,400,000

BOILER POWER.

Building	Pounds steam	H. P.
Administration	8300	240
Physics	4500	130
Manual Arts	4500	130
Gymnasium	3800	110
Auditorium	6600	190
Total		800

The actual fuel consumption for the first two buildings for the year 1916-1917 was 1632 bbls. crude oil. The estimated requirements were 1460 bbls. The estimate, which was made for the budget, did not make any allowance for overtime or night sessions of which there were two or three each week.



TEMPORARY HEATER PIPING.

TOTAL DEMAND ON PLANT.

	H. P.
Heating load	800
Pool heating	50
Cooking	20
Hot water	30
Total	900

Four 200-H. P. boilers were considered sufficient for the entire group of buildings as projected.

That the estimates were very close to the actual loads is shown by the following statement:

Building.	Estimated Load, B. T. U.	Actual Load, B. T. U.
Administration	8,050,000	7,900,000
Gymnasium	4,100,000	4,300,000
Auditorium	6,400,000	5,800,000

FACTORS AFFECTING THE DESIGN.

For architectural reasons it was not possible to obtain enough head-room for the installation of water-tube boilers.

The entire plant was designed with a view of expansion, and only such apparatus was installed as was necessary for each unit.

The boilers installed are two in number, each 84-in. x 18 ft., of 200 H. P. rating and built for 150 lbs. working pressure. The average working pressure of the plant is only about 80 lbs. but high-pressure boilers are used in all the work of this district on account of the greater margin of safety, and a much more substantial boiler is ob-

tained for a very little additional expense. There is provision for two more boilers which can be installed as additional buildings are erected with no changes in the plant except the extension of the steam header and breeching, etc.

HEATING THE CIRCULATING WATER.

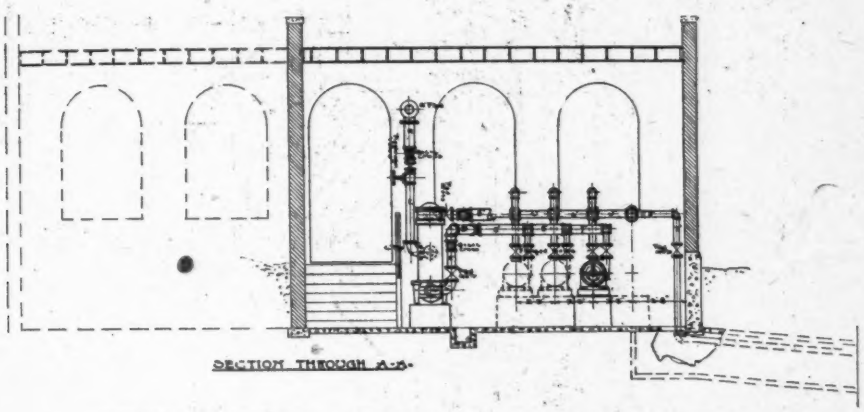
The circulating water is heated in two high-pressure heaters, one No. 18 Wainwright and one Otis of equivalent capacity. The water of condensation from the heaters passes to Cranetilt traps and is discharged by them to the receiving tanks whence it is returned to the boilers by the feed pumps. On the way to the receiving tank the hot condensation is passed through a No. 2 Wainwright heater which is installed in a shunt from the return side of the system. This was done to avoid the loss due to high-pressure returns flashing into steam when discharged by the traps.

No attempt was made to use the exhaust from the steam-actuated auxiliaries in the heating system proper. The exhaust from all auxiliaries is used for heating the domestic hot water and the condensation is wasted to the sewer to avoid any possibility of oil entering the boilers.

Temperature regulation is effected by means of thermostats located in the flow header, and diaphragm valves in the steam supplies. These thermostats are set by hand to maintain the required water temperature, according to weather conditions.

There are two 6-in. x 4-in. x 6-in. duplex, all brass-fitted, outside end-packed boiler-feed pumps which are controlled by a No. 4 Mueller pump governor.

The water for the heating system is circulated by means of two 4-in. and one 5-in. centrifugal pumps, with rated capacities of 300 and 400 gal. per minute, respectively. These pumps are direct-connected to 900 R. P. M. three-phase motors.



PERMANENT PIPING AS INSTALLED WITH SECOND UNIT.

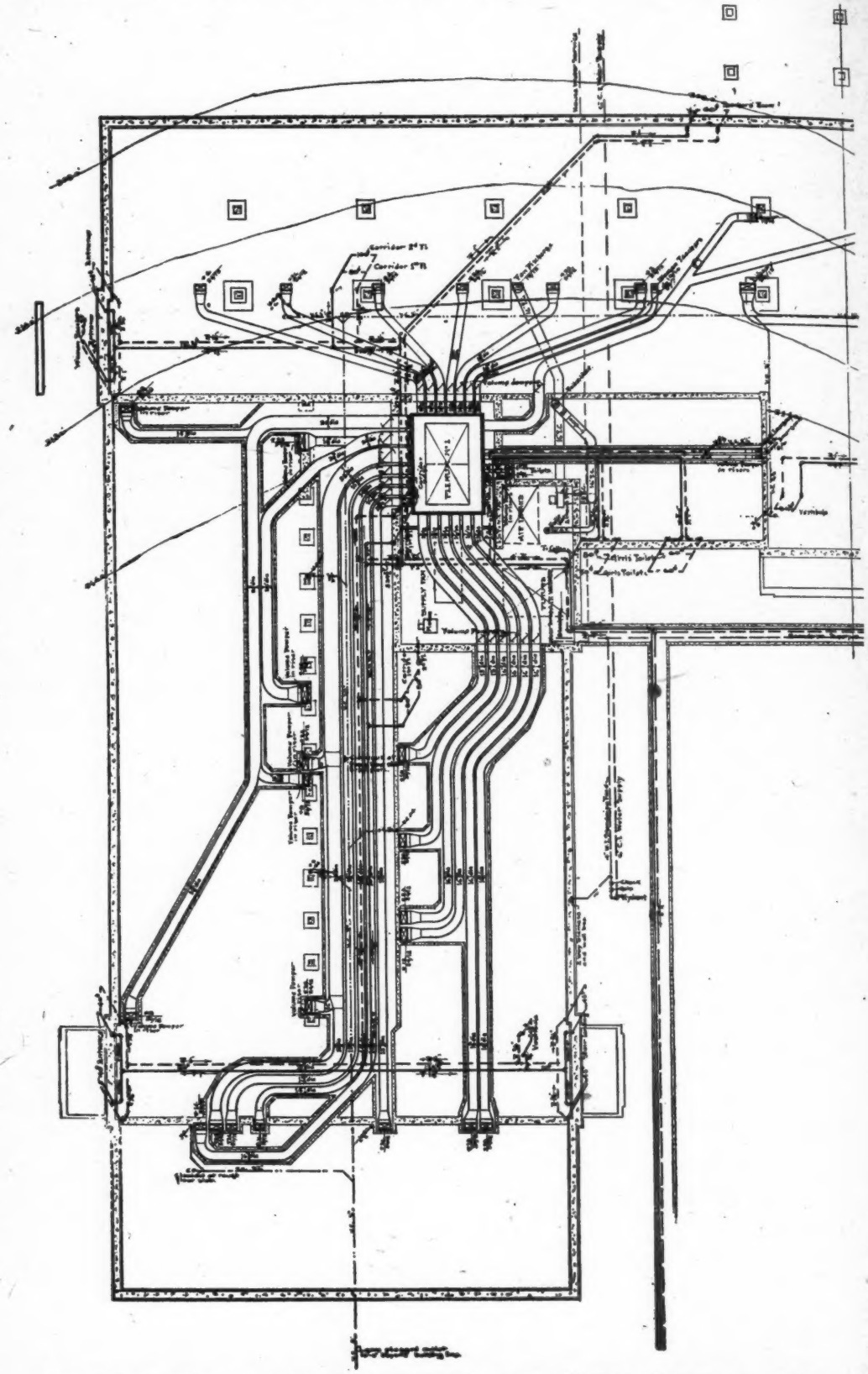
The pumps, heaters and building branches are all connected in parallel and all connections are valved to provide for regulation and to facilitate repairs. All mains are carried underground to the buildings, the longest circuit being 900 ft.

FRICTION LOSSES.

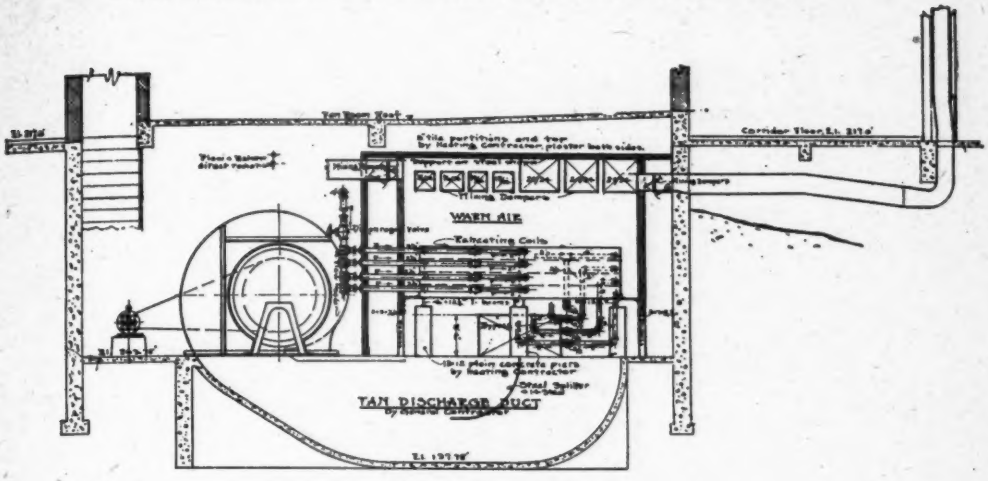
The friction losses of the system were estimated to be as follows:

Loss in mains	30 ft.
Loss in buildings	4 ft.
Loss in plant	4 ft.
Total	38 ft.

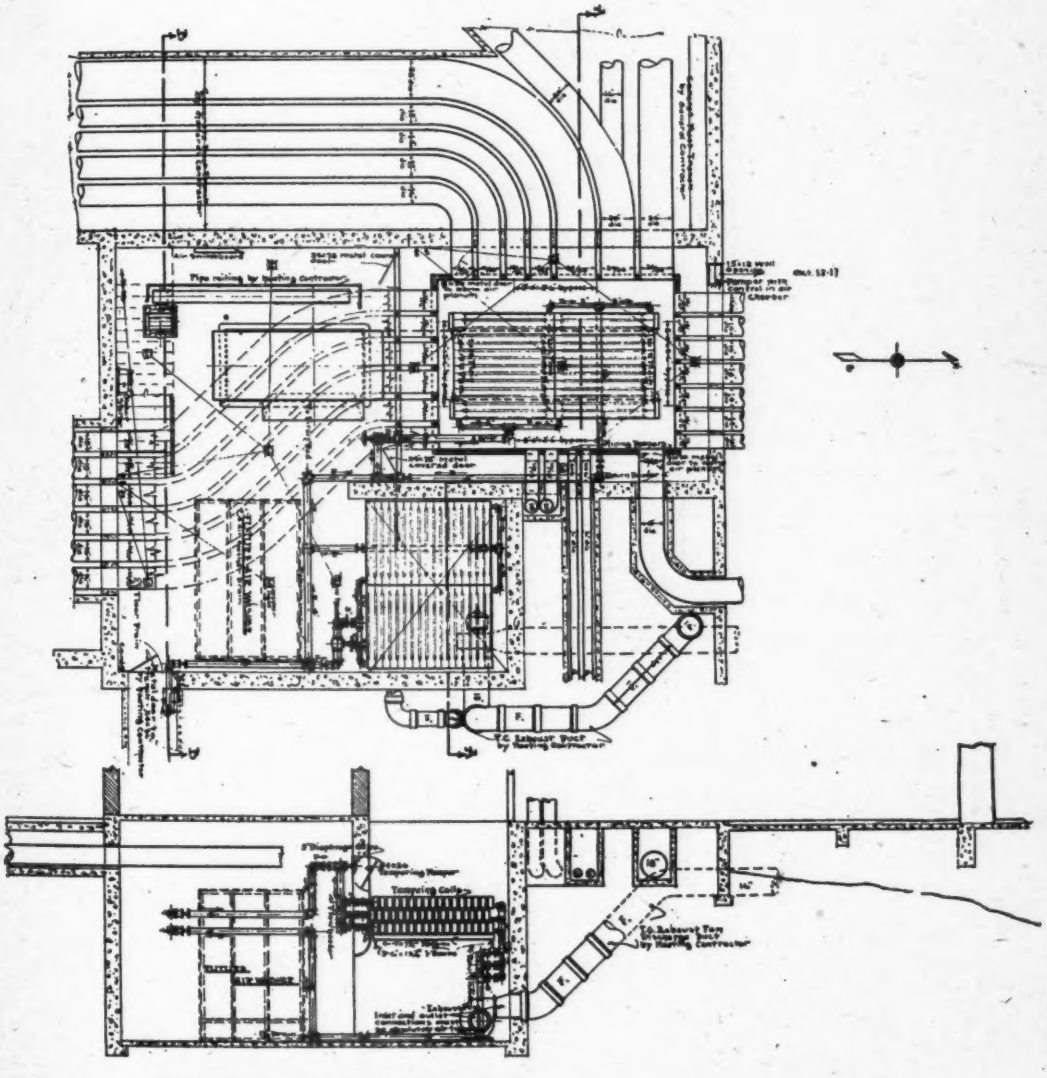
These losses were found in practice to come within 2 ft. of those as figured.



FRANKLIN HIGH SCHOOL—MAIN BUILDNG DUCT SYSTEM (ONE-HALF PLAN).



SECTIONAL ELEVATION THRU PLENUM.



SECTIONAL ELEVATION THRU AIR INTAKE.

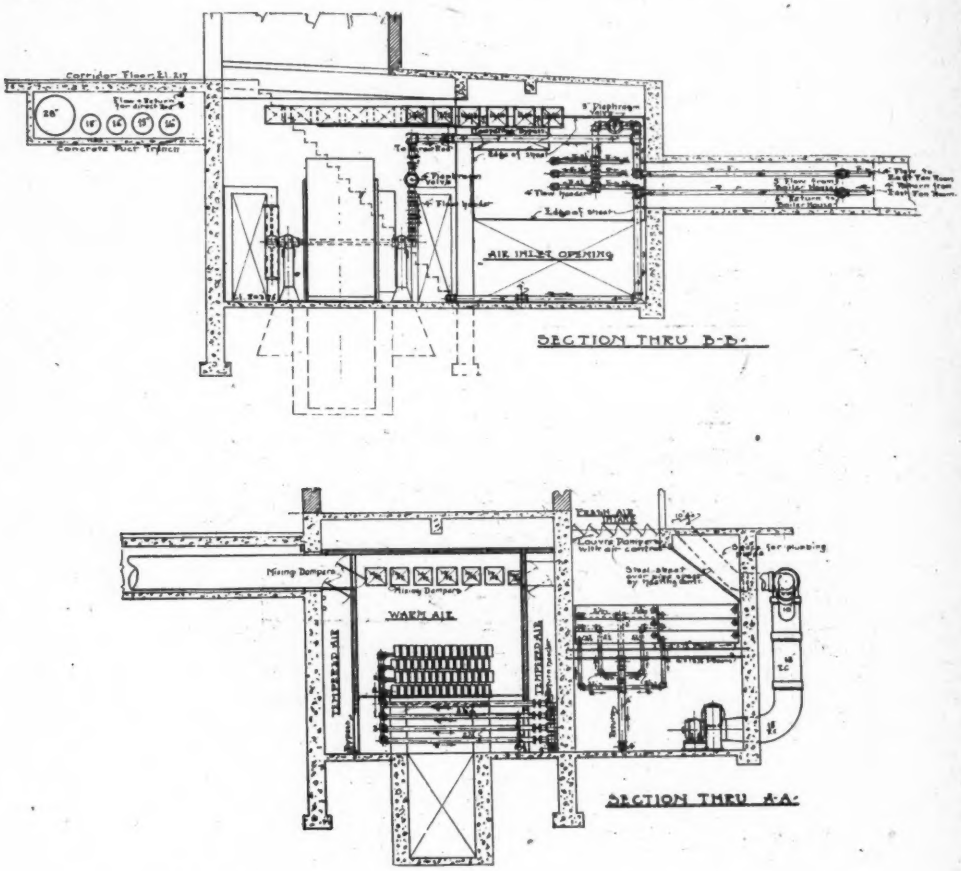
FRANKLIN HIGH SCHOOL—FAN UNIT NO. 1, MAIN BUILDING

EQUIPMENT OF BUILDINGS.

The buildings are fitted throughout with indirect fan systems, with radiators in corridors, offices and special rooms. Each building is provided with an open expansion tank and although no special provision was made for air venting, except the installation of compression air valves, there has been no trouble experienced from the accumulation of air in any part of the system. All piping was carefully graded however, and the same precautions observed as in the case of a steam plant, which may account for the absence of any air pockets.

The Administration Building is two stories high, without basement, and presented some problems as to the disposition of the supply ducts. These were installed in concrete trenches under the corridors just high enough to hold the largest duct and leave a clearance of 2-in. top and bottom. All ducts are of galvanized iron, round in shape and insulated with one layer of 14-lb. asbestos paper only. The trenches were reduced in size as the ducts to rooms were taken off and the trenches also served to house the piping for direct radiation and for the vacuum sweeper system.

The gymnasium, being two stories and basement, presented nothing unusual by way of installation and all ducts were installed on the basement ceiling.



DETAILS OF FAN UNIT NO. 1—MAIN BUILDING.

(To be Continued.)

CHICAGO COMMISSION ON VENTILATION

THE EFFECT OF SUNLIGHT ON AIR

Preliminary Report on Certain Laboratory Tests to Determine the Proper Technique in Handling Air Samples.

By WILLIAM J. MAUER, C. E.

Certain discrepancies have been noted on various occasions in the results of laboratory tests of CO_2 in air samples. In some instances, as low as 2 parts per 10,000 have been noted in samples which should have shown many times this amount. At various times, attempts have been made to ascertain the reason for these discrepancies. Special precautions were taken in cleaning, and in some instances, sterilizing the bottles, by the use of specially-prepared rubber stoppers, and by other means that would insure the cleanliness and air-tight condition of the apparatus. Careful calibration of the Peterson-Palmquist apparatus was also made. In spite of these precautions, we occasionally found samples containing a CO_2 content lower than that in the outside air. Furthermore, it was desirable to know whether intermittent samples taken at various times would truly represent the average CO_2 content of the room, and whether or not a continuous sample over an extended period of time would show similar results. It was deemed advisable, therefore, to investigate these matters by a series of laboratory tests.

TEST NO. 1.

It is reasonable to assume that one air sample taken in a room will not represent true conditions as to CO_2 content, as the single observation might be dependent upon some disturbing factor at the particular location in which the sample is collected, or it may be that the number of occupants of the room is changing, or an accumulation of CO_2 might occur at certain points due to stratification or air currents, or a marked variation might occur at different periods during the day. This test was therefore made to determine the average CO_2 at a definite place in a room over an extended period of time, and to check against this, small intermittent samples were also taken.

A one-liter aspirating glass bottle was used. This bottle, besides the regular opening at the top, had an additional opening at the extreme bottom edge. A glass tube through which the air was to be drawn, was inserted through the rubber stopper and at the top of this glass tube was placed a capsule from Dr. Hill's dust counter. The capsule was provided with a standard ½-in. cover glass, smeared with adhesive mixture as per specifications for use in Dr. Hill's dust counter. This was added to the glass tube to see if it would be possible to obtain the average dust count at the same time that the average CO_2 count was determined. The opening at the bottom was provided with a piece of rubber tubing and a pinchcock. The bottle was filled with a saturated solution of NaCl.

A strip of paper graduated on a time basis was placed on the side of the bottle as a gauge to determine the rapidity of flow, which flow was adjustable by means of the pinchcock at

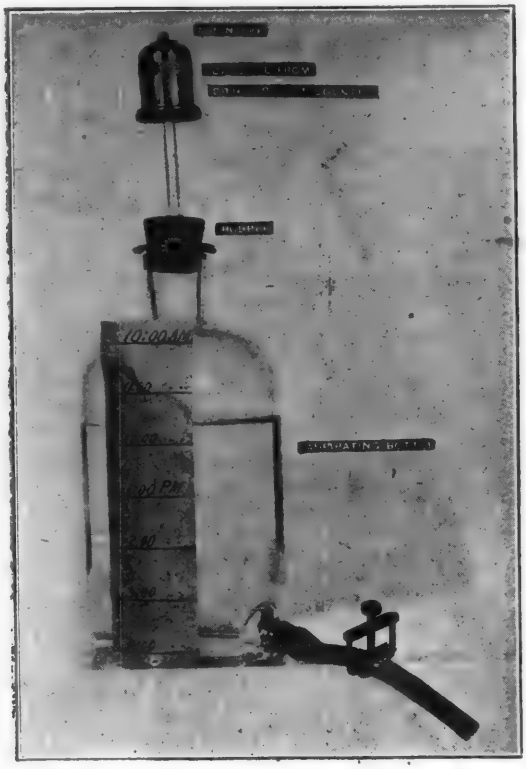


FIG. 1—ARRANGEMENT OF ASPIRATING BOTTLE USED IN FIRST TEST.

TABLE NO. 1—CO_2 TEST NUMBER 1.

With Capsule at Tip.

Test made August 15, 1917.

Time	Occupants	CO_2 in 10,000	Dust per Cubic Foot
10:00	26	5.2	6000
10:30	24	5.7	7000
11:00	25	4.6	7000
11:30	20	4.2	6500
12:00	18	4.1	6000
12:30	20	5.5	6000
1:00	18	5.1	6000
1:30	6	3.5	5000
2:00	10	4.0	5000
2:30	19	4.5	8000
3:00	29	5.7	7000
3:30	20	3.8	7000
4:00	14	5.8	6500
Average	19	4.8	6400
Continuous sample.			
Six Hours	19	3.4	6000

the outlet. The test was conducted in a room where the number of occupants changed during the course of the experiment but where this change was not very rapid.

Fig. 1 shows the bottle as set up and Table 1 gives the results. It will be noted from the table that the continuous air sample was .06 part per 10,000 lower than outside conditions and 1.4 parts lower than average conditions. The dust content checked very closely. The apparent reason at that time for this discrepancy in the CO_2 was that the varnish from the disc in the capsule might have absorbed some of the carbon dioxide in passing into the bottle for it was necessary that all the air taken into the bottle must first pass through this capsule and deposit its duct on the glass disc.

TEST NO. 2.

Test No. 2 was conducted in a similar manner to Test No. 1, except that

FIG. 2—ARRANGEMENT FOR SECOND TEST WITH CAPSULE FROM DUST COUNTER OMITTED.

the capsule from the dust counter was omitted and the accompanying intermittent dust count likewise omitted. The capsule was omitted in this test because the object of the test was to determine whether the continuous sample could be made to equal the average sample; it was therefore necessary to keep the apparatus free from any influences which might give untrue results.

Fig. 2 shows the apparatus used, which, as before, was placed in the position of average condition of the same room as experiment No. 1. The results are given in Table 2 and appear to be very consistent.

TABLE 2—CO_2 TEST NUMBER 2.

Without Capsule at Tip.

Test made August 20, 1917.

Time	Occupants	CO_2 in 10,000
10:45	28	5.2
11:45	21	5.0
12:45	9	3.7
1:45	18	5.0
2:45	24	4.2
3:45	30	4.5
Average	22	4.6
Continuous sample.		
Five hours	22	4.4

TEST NO. 3.

It was demonstrated in Test No. 2 that it was possible to obtain a continuous air sample in a room, which checks very closely to several intermittent air samples taken at the same point. It was therefore desirable to make a third test to find out if the adhesive mixture in the capsule of the first test affected the carbon dioxide content of the bottle. For this purpose Test No. 1 and No. 2 were combined into one; the apparatus used being shown in Fig. 3. Since the dust count was not the object of this experiment, the counting was omitted, but the adhesive mixture in the capsule was used as is regular in taking a dust sample.

Table 3 shows confusing results. The sample with the capsule was higher than the average of intermittent samples while the continuous sample without the capsule was lower—being 0.5 parts of 10,000 lower than average conditions.

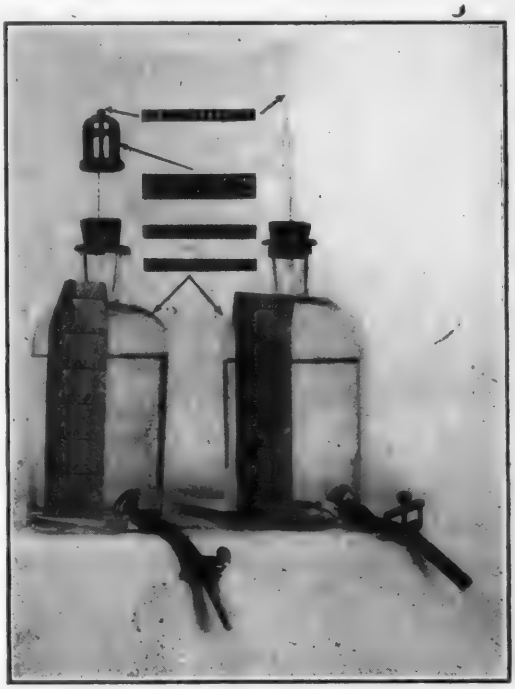


FIG. 3—ARRANGEMENT TO DETERMINE WHETHER ADHESIVE MIXTURE IN CAPSULE AFFECTED CARBON DIOXIDE.

TABLE 3—CO_2 TEST NUMBER 3.

With and Without Capsule at Tip.

Test made August 24, 1917.

Time	Occupants	CO_2 in 10,000
11:00	25	6.8
12:00	20	4.3
1:00	9	4.5
2:00	11	5.7
3:00	18	5.8
4:00	24	5.4
Continuous sample with capsule.		
Five hours	18	6.5
Continuous sample without capsule.		
Five hours	18	3.5

TEST NO. 4.

This test was made to determine the consistency of the results obtained in a continuous air sample. The apparatus used for this test is shown in Fig. 4, it being the same as that used in Test No. 2, except that two bottles were used, with glass tubes drawn to a sharp point and bent in such a manner that the intakes through these points were brought to exactly the same position. The results of this experiment checked very closely, although not absolutely.

In discussing the discrepancies in the previous tests with the chemist of the laboratory, no satisfactory reason could be given for such variable results.

The chemical laboratory is at the south end of the building, and was exposed to the direct rays of the sun during certain times of the day, and it was noted that the samples of air brought to the laboratory were allowed to stand on the laboratory table until such time as it was found convenient to make the analysis. These bottles sometimes stood from one to two days before the contents were tested. During this time they were often subjected to the direct rays of the sun. The writer suggested to the chemist that possibly the sunlight had some effect on the air samples. He scoffed at the idea that carbon dioxide could be affected by sunlight. This same point was brought to the attention of other chemists, all of whom, along with some members of the Chicago Commission on Ventilation, concurred in the views of the chemist. In spite of these facts, the writer decided to make some tests for his own satisfaction, bearing on this subject.

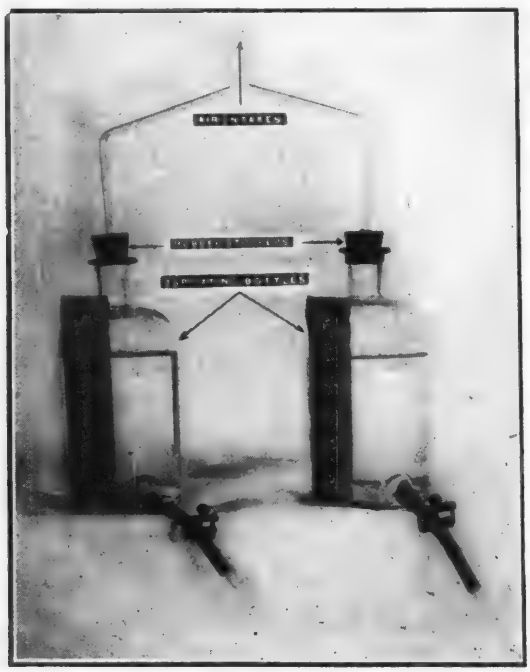


FIG. 4—ARRANGEMENT TO DETERMINE CONSISTENCY OF RESULTS OBTAINED IN A CONTINUOUS AIR SAMPLE.

FIG. 5—ARRANGEMENT TO TEST EFFECT OF SUNLIGHT ON AIR SAMPLES.

It is well recognized that CO_2 is a stable oxidation product unaffected by the ordinary conditions to which it might be subjected in this work. The writer felt, however, that certain substances hitherto undiscovered might be present in the expired air, which would act as deoxidizing agents when placed in sunlight, and thought it desirable, therefore, to make the test which follows:

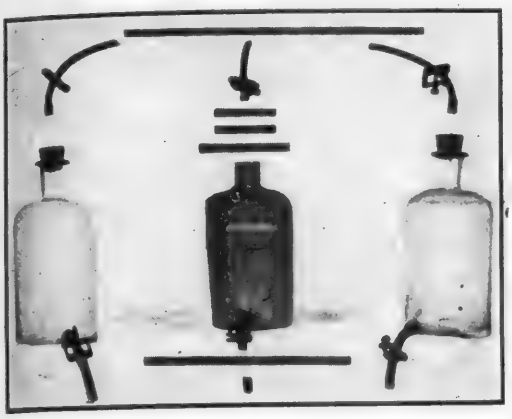


FIG. 6—SAME ARRANGEMENT AS IN FIG. 5, WITH NEW SET OF STOPPERS, RUBBER HOSE AND PINCHCOCK.

TEST NO. 5.

The method of conducting this experiment was as follows: Three separate air samples were taken in similar bottles under identical conditions, containing originally a high CO_2 content. The volume of each sample was sufficient to permit five or six smaller samples being withdrawn from each bottle, after the latter had been exposed to direct sunlight for 24 hours. That is, the original sample was removed from the bottle and analyzed. The gross sample was then subjected to sunlight for 24 hours and another sample was withdrawn. After another exposure of 24 hours, a third sample taken, etc., until the supply was exhausted.

The three bottles used were of the same kind as in the previous test and the tips of the glass tubes were brought to a common point so that the content in each of the three bottles would be practically the same. One of the three bottles was covered with heavy brown paper; the bottom, however, was left uncovered. One of the operators entered the cabinet known as " Seldom Inn," as shown in Fig. 7. This test cabinet is located on the top floor of the City Hall, and is constructed of galvanized iron, and has windows on one side. The total volume is 84 cu. ft. The operator remained in this cabinet for 45 minutes and as the cabinet was well sealed, it was assumed that a comparatively high CO_2 content would result. The operator then opened the pinchcocks at the bottom of each bottle and allowed the respired air from the cabinet to replace the salt solution in the bottles.

It was impossible to maintain the same velocity flow from these bottles, and this may account for the slight difference in the initial CO_2 reading of the three bottles. After the bottles were filled with the air, a new set of stoppers with glass tube, rubber hose and pinchcock, as shown in Fig. 6 were placed in them. This was done to simplify the laboratory method of extracting samples from the bottles. These bottles were immediately taken to the laboratory and a small sample of each was analyzed. To obtain this sample an equal volume of saturated solution of NaCl was used to displace the air in the bottle. This solution does not absorb CO_2 and was therefore considered safe to keep in contact with the remaining air in the bottle.

The bottles were then taken to the roof of the City Hall at a point where they would not be disturbed and where they would receive the maximum

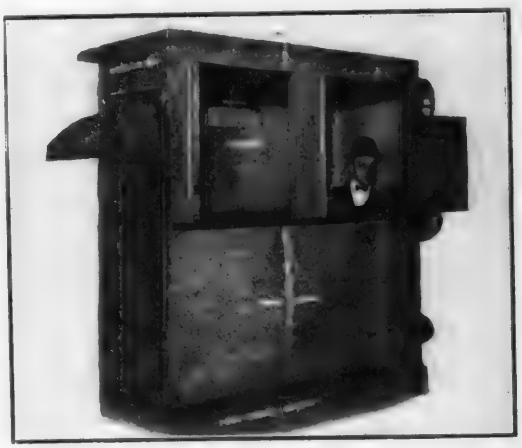


FIG. 7—CABINET FROM WHICH AIR SAMPLES WERE TAKEN IN TEST NO. 5.

amount of sunlight. They were placed on their sides and on white paper. Twenty-four hours later these bottles were again taken to the laboratory; another portion of the air removed and sampled directly from the bottles and again placed on the roof as in the first case and so on until the entire contents of the bottles had been used up.

NOTE: The bottom of the bottle, whose sides were covered, was not covered and naturally some light would enter. The paper used for covering the sides was not entirely impervious to light.

The results of these tests are shown in Table 5. Each 24 hours of exposure showed a decided drop in carbon dioxide content. The covered bottle, at the end of 120 hours had lost about 36% of its carbon dioxide. Uncovered bottle No. 1 lost about 73%, while uncovered bottle No. 2 lost about 78%. It is evident that something had taken place inside these bottles. This change may have been due to the heat of the day and cold of the night causing expansion and contraction of the gas in the bottle, thereby causing a leakage through the stopper, although every precaution was used to prevent this occurrence. Or it may have been that rain during the night affected the contents of the bottles. It is more rational to assume, however, that micro-organisms or other matter present in the expired air assisted by the direct action of the sun's rays had a decided effect on the carbon dioxide content of the air samples.

It is too early to draw conclusions from these tests. They will be repeated under somewhat different conditions, and an endeavor made to determine specifically the cause of the reduction in the CO_2 content of the bottles exposed to sunlight.

The tests indicate that the sunlight is the important factor—at least it influences these results—but it is desirable to ascertain, if possible, what other substances or conditions were present to bring about this result. It emphasizes also the necessity for extreme care in collecting, handling and analyzing air samples for CO_2 if the results are to be of value.

TABLE 5—CO_2 TEST NUMBER 5.

To Determine Effect of Sunlight on Sample of Air.

Test made September 5 to 10, 1917.

Hours of Exposure		Weather Conditions	CO_2 in 10,000			Loss in CO_2			
			Cov'd	Uncov'd	Uncov'd		Uncov'd	Uncov'd	Av. loss
Each case	Total		bottle	Bottle No. 1	bottle No.2	Covered bottle	bottle No. 1	Bottle No. 2.	uncov'd
0	0	No exposure	52.2	48.0	54.0	—	—	—	
24	24	Bright sunshine. rain during night	46.5	38.5	32.5	5.7	9.5	21.5	15.5
24	48	Bright sunshine Rain during night	39.2	22.5	18.0	7.3	16.0	14	15.3
24	72	No sunshine. Rain day and night.	36.0	*10.0	18.0	3.2	**	0	0
48	120	Cloudy most of time. Sunshine only few hours.	33.5	13.0	11.5	2.5	9.5	8.0	8.0
		Total of above.....				18.7	35.0	38.0	
		Average per 24 hours.....				3.7	7.0	7.5	7.8

* Probably incorrect. ** Assuming no loss.

CENTRAL STATION HEATING

ADVANTAGE OF THE COMBINATION CENTRAL STATION HEATING PLANT

Recommendations Put Forth by Bureau of Mines for Combining Central Station Heating Systems with Steam Power Plants.

By JOHN C. WHITE.

Under the title of "Central Station Heating; Its Economic Features with Reference to Community Service," the Bureau of Mines has issued a bulletin (Technical Paper 191) under the authorship of John C. White, State power plant engineer for Wisconsin, that champions, among other things, the use of meters with an equitable demand charge, and the sale of the steam heat as the principal product, with electric current following as a by-product. The principal portions of the paper are given herewith:

Heat is a fundamental requirement, a prime necessity for which there is no substitute; artificial light is convenient, but not absolutely necessary. Furthermore, light may be had from other sources in greater volume and at less cost than from electric current. Central station heating affords an opportunity for a great saving in the total fuel consumed by a community, at the same time furnishing electric energy in greater quantity and at a less cost than otherwise. To make such a service a success, however, some important factors must be considered and better methods and designs must be worked out.

COMPETITIVE NATURE OF SERVICE.

The test of any such project is its ability to furnish a satisfactory service for the price that may be obtained. This price is and should be competitive. One of the most important factors in the sale of steam for heating is the economy with which the steam will be used. The early method of charging for the service was based on the amount of radiation installed. A later method was based on the cubic feet of space heated. The present method, and the only proper one, is to meter the condensation and to charge the consumer for the heat supplied as he is charged for any other commodity, leaving him to exercise or not the same economy in the use of steam that he did in the use of coal that he formerly bought.

EARLY RATES AND COSTS.

As regards selling steam on the basis of square foot or radiation, although many of the early companies charged a rate of only 20 cents a square foot for a season of 7 to 8 months, the fuel cost of energizing such radiation for a period of only 6 months (180 24-hour days) with an over-all efficiency of 50% in generation and transmission, steam at atmospheric pressure and a room temperature of 70° F., would be from 10 cents to 15 cents with coal at $1 a ton. As few places get their coal at that price, it is easy to see why these heating companies failed. Many electric companies claim a cost of less than 1 cent per kilowatt hour at the switchboard; the public, however, except a few large consumers, pays three to

ten times that amount for what it uses. Steam heating can never carry such an excess as that, but there must be a margin for operation, distribution, overhead costs, and profit.

(The author here presented an analysis to determine what difference exists between the cost of central station service and of private heating, showing that the fuel costs for the heat are about the same, whether furnished by the private plant or from a central station, with the same coal at the same price.)

However, there are these differences: The central station can work at a higher sustained efficiency, it can produce electric current as a by-product with only a small loss of heat generated, and it eliminates all of the objectionable features of a private plant.

Whether or not it is exhaust steam in whole or in part has no bearing on the case; any allowance in that direction should affect the price of current and not the cost or the value of the steam. The steam should be considered the prime requisite, with any output of incidentally-derived current as the by-product. It will then stand or fall on its own merits, which is the only substantial measurement of its value.

As regards the generation and transmission costs and margins, with coal at $3.00 a ton and an overall efficiency in the plant of 70%, the steam can be delivered at a fuel cost of approximately 30 cents a square foot of radiation served. This allows 20% for loss in transmission, a figure considerably higher than that found in practice, as evidenced by a report of the Bureau of Mines, where this loss is given as 4 to 12%. The same coal will cost the private user about $4.00 a ton delivered at his premises, and his fuel cost for the same amount of heat will therefore be not less than 40 cents. But he still has the smoke, dirt, and labor inseparable from the use of soft coal in such equipment as he uses.

How much is the elimination of these objectionable items worth? Based on the relative costs of the soft coal and those substitutes—anthracite and coke—which most nearly accomplish the desired end, so far as smoke and dirt are concerned, it is worth from 100% to 150% more than the estimated cost of the heat as computed at 40 cents, making the real value 80 cents to $1.20 a square foot a season. These values may seem high, but when the economy that is practiced in the use of hard coal at $8.00 to $9.00 per ton is considered, they are probably not far from correct. Storm windows are in evidence at the first frost, ventilation is sacrificed, and no space is heated that is not absolutely needed.

COMPARISON OF COSTS OF SERVICE FROM PRIVATE PLANT AND CENTRAL STATION.

The use of the fuels of higher grade eliminates nearly all of the smoke, part of the dirt, and some of the labor; but it is still necessary to provide and maintain a furnace and furnace room, and coal storage, to buy coal, haul out ashes, and do the firing and cleaning. These items may be estimated to cost approximately 50% of the value of the soft coal burned. Assuming that the investment is already made in the private plant, we can make no charge against that except for repairs; these can be neglected, as can also any charge for space occupied by equipment, coal, or ashes. Adding the 50%, or 20 cents a square foot as determined above, to each of the costs for the various fuels, gives us rates of 60 cents, $1, and $1.40, respectively, for Illinois coal, anthracite, and coke.

The central station can deliver the heat for a fuel cost of 30 cents, thus leaving margins of 30 cents, 70 cents, and $1.10 to cover labor, maintenance, overhead charges, transmission, and profits. In addition the station has eliminated every objectionable feature of the service and made it a conveni-

ence instead of a nuisance. It is a fact worthy of note that central-station heating plants are most numerous where coal is abundant and cheap, as in Pennsylvania, Ohio, Indiana and Illinois.

ANOTHER METHOD OF COMPUTING COSTS.

If the problem be viewed from another angle, the cost of evaporating a given quantity of water in the large public-service plant as against the small private plant may furnish a better basis for comparison. With Illinois coal at $1 a ton the fuel cost of evaporating 1,000 lbs. of water (generating 1,000 lbs. of steam), should not exceed 7 cents, and in a well-designed and carefully operated plant may be as low as 6 cents. The other costs will increase this figure to about 10 cents, and with coal at $3.00 a ton, the total cost will be about 25 cents. The private consumer can not evaporate the water any more cheaply, even with coal at the same price, and as he will have to pay more for his coal, the cost to him of evaporation will be more. Furthermore, when he only requires a little heat his efficiencies drop very low and his losses are correspondingly great.

In the former estimate of the cost of supplying 1 sq. ft. of radiation for 180 days, a rate of emission of 2.5 B. T. U. per square foot of surface and per degree difference of temperature per hour was used. This rate shows that 1,500,000 B. T. U. will be required to energize 1 sq. ft. of radiation for the 180-day period. In evaporating 1,000 lbs. of water there will be a heat transfer of approximately 1,000,000 B. T. U. at a cost of 25 cents with coal at $3 per ton. From these figures it evidently will cost 38 to 40 cents to evaporate the water for each square foot of radiation supplied. To this figure must be added all investment, operation, and other charges on the plant and distribution system. These can only be approximated in a general estimate, but they will probably equal the fuel cost, thus bringing the total up to 75 cents or 80 cents a square foot a season. The reader should bear in mind that in the computations made on the quantity of heat emitted the radiation was assumed to be active for the entire period. This will not necessarily hold in practice, and less heat will be required than the amount charged in this discussion. It makes little difference, however, as the lessening will be of about the same amount whether the radiation system is heated privately or from a public-service main.

(The author here quoted rates from different cities showing that the average minimum and maximum rates for 28 cities, on quantities of 4,000 lbs. or less and 300,000 lbs or more per month, are 76.40 cents and 45.33 cents, respectively, confirming in general the costs established herein for furnishing 1000 lbs. of steam. It is pointed out that in about half of the schedules mentioned there is a demand charge of $3.00 a month minimum on all buildings having a capacity of 25,000 cu. ft. of space or less, and of 12 cents per 1000 cu. ft. on all buildings having more than 25,000 cu. ft.)

The quantity of heat necessary to supply 1 sq. ft. of radiation for a season is probably less than the estimate already given. There are many days when little or no heat is required. At such times the consumer can reduce his active radiation with less trouble than he can allow his fire to go out and be rekindled. The central station has a decided advantage also in that the boiler capacity in service can be adjusted to the load and the maximum efficiency can thus be maintained.

As with some electric schedules, many rates for steam throw a burden on the small consumer by forcing him to help pay for the large consumer's service. In the case of steam no consumer should be given service for less than a profitable rate. In rates for electric service there is some justifica-

tion for the apparent discrimination as between the large and the small consumers. The former may make their heaviest demands at times when the load is otherwise small and thus increase the station load factor. In a central station steam plant the load varies little during the entire day; the demands for steam go up and down with changes of wind and temperature. Such changes are gradual and give ample time for controlling the operation of the plant so that the highest possible economy can be realized. Daily peaks are almost negligible.

EXHAUST STEAM.

Thus far exhaust steam has not been considered, because there is no difference between it and live steam at the same pressure, and any exhaust steam that may become available for distribution costs just as much and it is worth just as much for heating as though a part of its original energy had not been converted into useful work. In a combined plant the product resulting from such conversion—usually electric current—should be considered the by-product.

Where the heating load is large enough to entirely submerge the power, load, there will be no peaks in the boiler room through variations in the latter. The power requirements may vary from zero to maximum and the fireman will not know it unless some one tells them or they consult the records. When the engines are exhausting their maximum into the heating system, the reducing valves will automatically cut the supply of live steam to the required amount; when the power load is a minimum they will open and supply live steam to meet the requirements.

(The author illustrated his point with curves, from records of the State capitol power plant at Madison, Wis.)

The early efforts—and, perhaps, those of the present—sought to adjust the loads in a combined power and heating plant so that the exhaust steam, considered as a by-product, would do the greater part of the heating, as much live steam as might be necessary being introduced in severe weather. In the average central station such adjustment is practically impossible because of the wide variation in the power requirements during the day and the comparative uniformity of the heating load. In consequence, some exhaust steam is wasted during part of the day and considerable live steam is required at other times.

This procedure leads to the establishment of heating service rates that are too low, and it is wrong in principle for the reason that it discounts the value of exhaust steam. Fortunately, in some of the successful plants the heating load crept up until a favorable relation existed and, had the rates been equitable, a much better showing could have been made. Where the service is good it is not difficult to book all of the business, or a satisfactory part of it, along the mains. The central station that can supply both heat and current stands a much better chance of displacing the isolated plant than the one that can bid for the current only.

In cities of medium size the same boiler capacity that can supply three to four blocks with current will heat only about one. This fact should make it comparatively easy to take on a suitable heating load within easy distance of the plant where the latter is situated favorably with regard to the district served. By a suitable heating load is meant one in which the power ceases to be a factor so far as the boiler requirements are concerned.

RECOMMENDATIONS.

Based on the foregoing discussion, it would appear advantageous to:

Select plant locations favorable to the district to be served.

Adopt more permanent construction materials and improved designs:

Submerge the power load entirely at all times during the heating season.

Put all consumers on meter rates with an equitable demand charge.

Run compound engines, or exhaust turbines tandem to simple engines during the summer months.

Engineering Bulletins of the U. S. Fuel Administration.

Engineering Bulletins Nos. 1 to 5 of the United States Fuel Administration, have now been issued. No. 1 is devoted to "Boiler and Furnace Testing." No. 2 discusses "Saving Coal in Steam Power Plants." No. 3 deals with "Boiler Water Treatment." No. 4 is on "Combustion and Flue-Gas Analysis," while No. 5 is devoted to "Burning Steam Sizes of Anthracite," with or without admixture of soft coal.

Probably the most useful bulletin to the heating engineer is Bulletin No. 5, although all are interesting, especially Bulletin No. 2, with its diagram of the utilization of the heat of the fuel, from its generation in the boiler to its final use in the heating system.

In burning steam-size anthracite, or mixtures of this with soft coal, the bulletin states that slight alterations in the method of firing and in the furnace itself are necessary. Just what volume of air and what strength of draft to use are best determined by actual trial.

With ordinary furnace equipment designed for soft coal, up to 20% "buckwheat" or fine sizes of anthracite may ordinarily be burned without any change of equipment or firing practice. As most boiler furnaces are operated below their normal capacity on soft coal, 20% of anthracite can be added without decreasing the capacity of horsepower output of the boiler plant.

If a greater percentage of anthracite screenings, 20% to 40%, say, is mixed with the soft coal, it will be necessary, in order to obtain full boiler horsepower, to produce air pressure under the grate. A small blower of the turbine type is recommended for this purpose, or a steam jet blower may be used.

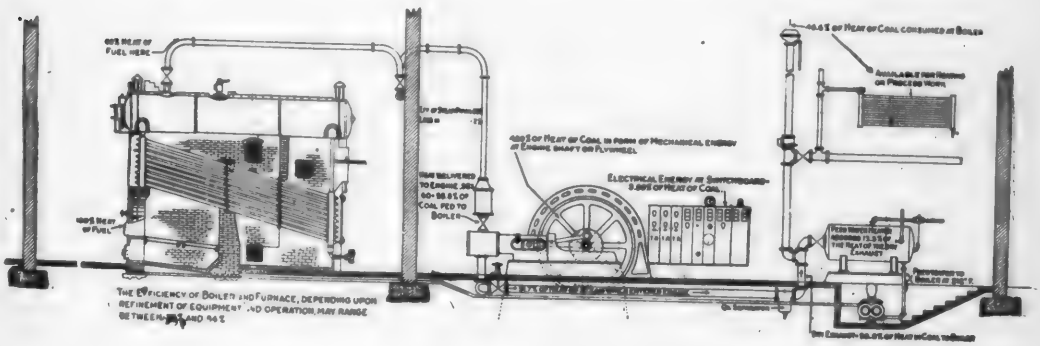
If more than 40% of small anthracite is used, the equipment recommended is forced draft, plus "buckwheat" grates and a good automatic draft regulator. The grates should vary in the matter of diameter of air openings, draft area, and total surface in accordance with the specific fuels used and their proportions in the mixture.

Some plants are able to run efficiently on 100% of a good quality of fine anthracite if properly equipped.

Proper mixing of soft coal with anthracite is essential. It can be done either by delivering in a wheelbarrow alternate and predetermined portions of the two kinds of coal, and then mixing by not less than two "turnovers" with a shovel before dumping in front of the furnace, or, on a larger scale, by a similar delivery of carload lots to the coal tipple.

Data are also given in the bulletin regarding grates and firing.

In connection with the heat-balance diagram which is reproduced herewith, it is pointed out that steam, after pasing through the engine, should not be considered as a waste product. It still represents a large percentage of the heat delivered by the boiler. It is the principal product of the plant, while power is the by-product.



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WHETHER it is the spirit of the new times or not, the attitude of employers, especially in the enginering line, toward their staffs, as exemplified at a recent salesmen's convention, was striking enough to deserve more than passing comment. In the first place, there was a spirit of comradeship in evidence that was too genuine to be dismissed as merely due to the exuberance of the occasion. But more important than that, the interest of the employers, amounting even to a solicitude, in the welfare of each individual member of the organization, betokened an attitude that must have been very reassuring to the men themselves, as well as indicating a generous confidence on the part of the management. For instance, the boast was made by one executive that of the total number of men at various times in the employ of the company, nearly 70% were still on the rolls. "This," he said, "is a record the company wants to maintain. We do not want to lose our men!"

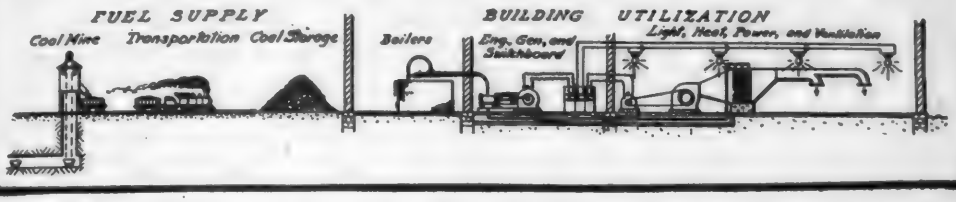
To those of us who remember the old days when a man's chief concern was holding on to his position, the new order of things must seem like a bit of the millennium. But if it is, it simply goes to show that the millennium is based pretty much on common sense. It does not take time studies or motion studies to prove that a man's best efforts are given when his mind is free from unnecessary anxieties and it is a safe wager that one who is reasonably assured of the permanency of his position is going to render more efficient service than the man who feels uncertainty in this regard, and who, more likely than not, for that very reason, fails to inspire in his employers the proper degree of confidence.

As was emphasized by another speaker, the new status of the sales force is not to be considered a one-sided arrangement, by any means. Sound advice was forthcoming that loyalty to the organization means something more than a negative or selfish interest. It is a case of team work, of pushing at the point where the push is most needed and, moreover, of sticking to the ship in good weather and bad. The speaker went a step further. "The time may come," he declared, "when, in the company's interests, you will be asked to take up work from which you have long since graduated. When called upon to do that sort of thing, take off your coat and jump in. Make the sacrifice, if necessary, in the interest of the organization. The management will not forget it and when better times come around, you will have your reward."

Incidentally, the marked success of the company, based upon the plan of operation here indicated, is about as good evidence as could be produced of the soundness of the scheme.

"Buy only what you need, but buy it now" is a common-sense slogan that we are glad to pass along at this vital period of after-war adjustment.

POWER PLANT ENGINEERING



DESIGNING DATA FOR POWER PLANTS

In the design of power plants certain basic data form the foundation of all calculations and the final design is only a suitable application of such data modified to suit the individual case. Probably the most frequent cause of confuson in power plant calculations is the lack of understanding of just what certain ratings and sizes indicate and within what limits the proportions between the various parts of the plant should vary. To facilitate references later made in this discussion a list is given in Table I of actual and approximate equivalents.

The first item which should be determined is boiler horsepower required, as the boilers are usually the biggest factor to be considered, these occupying more space and having to be connected to the stack with breeching, to say nothing of arranging them for convenient firing, accessible from coal pile and with due allowance for the replacement of tubes.

If the boiler plant is to supply steam to heat the building the heating load will quite likely be larger than the engine load, in which case the heating requirements will govern the size of the plant. On the other hand, if the plant is purely for power purposes, or if the power load requires more steam than the maximum heating demand, then the power requirements will govern the boiler capacity.

FIGURING COMPARATIVE POWER AND HEATING REQUIREMENTS.

To compare the power and heating requirements for any installation the *boiler horsepower* required for heating can be approximated from the formula

$$\text{B. Hp.} = \frac{\text{EDR}}{100} \qquad (1)$$

when B. Hp. is boiler horsepower
EDR is equivalent direct radiation.

Another formula is

$$\frac{\text{EDR}}{3} = 30 \text{ B. Hp.} \qquad (2)$$

Formula No. 1 is based on every square foot of equivalent direct radiation giving off 250 B. T. U. which, with 25% added for mains, makes $250 + 62 = 312$ B. T. U. per square foot; $312 \text{ B. T. U.} \times 100 = 31{,}200$ B. T. U. per 100 sq. ft. of EDR and it has been seen in Table I (D) that 1 H. P. equals 33,479 B. T. U., so that this allows a little leeway for additional losses.

Formula (2) is based on every square foot of EDR condensing (including losses on the mains) ⅓ lb. of steam per hour and therefore the pounds of steam required will be ⅓ of the EDR. As 1 boiler Hp. evaporates 30 lbs. of water (or slightly more at low pressure)—see Table 1 (D)—the total pounds of steam required are about 30 times the boiler horsepower necessary to supply the same amount of steam. This formula may be simplified to B. Hp. = EDR/90 which allows a little more for safety than Formula (1).

To obtain the *pounds of steam* necessary for power operation the following formula may be used:

$$W = 1\tfrac{1}{3} \frac{\text{Kw}}{\text{E}} \text{ w} \times 1.15 \qquad (3)$$

when
Kw = maximum kilowatts to be developed.
E = efficiency of generator.
w = steam consumed in pounds per hour per H. P. of engine.
W = total weight of steam per hour at maximum load
1.15 = a constant, adding 15% for auxiliaries.

Formula (3) is based on the maximum Kw. required at the switch board which, divided by the generator efficiency and this

TABLE I—EQUIVALENTS

(A) 1 Mechanical H. P. equals

746	watts
0.746	kw.
33,000	ft. lbs. per min.
550	ft. lbs. per sec.
2,546	B. T. U. per hr. (or roughly 1/13 of boiler H. P.
42.4	B. T. U. per min.
0.707	B. T. U. per sec.
0.175	carbon oxidized per hr.
2.64	lbs. of water evaporated per hr. from and at 212° F.

(B) 1 Engine H. P. Equals

11 to 14 lbs. steam approximately for triple expansion engines.
12 to 15 lbs. steam approximately for compound engines.
17 to 20 lbs. steam approximately for simple condensing.
18½ to 22 lbs. steam approximately for simple jacketed non-condensing.
24 to 35 lbs. steam approximately for simple unjacketed non-condensing.
15 to 19 lbs. approximately for turbine-condensing.
25 to 60 lbs. approximately for turbines-non-condensing.
60 to 200 lbs. steam approximately for piston and plunger pumps.

(C) 1 Mechanical H. P. Hour equals

746	watt hours.
0.746	kw. hours.
1,980,000	ft. lbs.
2,546	B. T. U.
0.175	lbs. carbon oxidized.
273,750	kilogram meters.
2.64	lbs. of water evaporated from and at 212° F.
17	lbs. of water raised 62° to 212° F.

(D) 1 Boiler H. P. equals

30	lbs. of water from 100° F. into steam at 70 lbs. gauge pressure.
34½	lbs. of water from and at 212° F. into steam at atmospheric pressure.
33,479	B. T. U. (or roughly 13 engine H. P.)
30	lbs. (approx.) of high pressure steam @ 100% rating.
45	lbs. (approx.) of high pressure steam @ 150% rating.
60	lbs. (approx.) of high pressure steam at 200% rating.
10	square ft. of heating surface in boiler (approx.)
100	square ft. of cast-iron radiating surface (approx.)

(E) 1 Kilowatt equals

1000	watts.
1.34	H. P.
2,654,200	ft. lbs. per hr.
44,240	ft. lbs. per min.
737.6	ft. lbs. per sec.
3414.5	B. T. U. per hr.
56.91	B. T. U. per min.
0.948	B. T. U. per sec.
0.2275	lbs. carbon oxidized per hr.
3.53	lbs. of water per hr., evaporated from and at 212° F.

(F) 1 Kilowatt Hour equals

1000	watt hours.
1.34	H. P. hours.
2,654,200	ft. lbs.
3,600,000	joules.
3,414.5	B. T. U.
367,100	kilogram meters.
0.235	carbon oxidized.
3.53	lbs. of water evaporated from and at 212° F.
22.75	lbs. of water raised from 62° to 212° F.

(G) I Lb. of Water Evaporated from and at 212° F. equals

0.293	Kw. hrs.
0.379	H. P. hours.
965.7	B. T. U.
103,900	kilogram meters.
1,019,000	joules.
751,300	ft. lbs.
0.0664	carbon oxidized.

(H) 1 B. T. U. Equals

1.055	watt seconds.
778	ft. lbs.
107.6	kilogram meters.
0.000293	kw. hrs.
0.000393	H. P. hrs.
0.0000688	lbs. carbon oxidized.
0.001036	lbs. water evaporated from and at 212° F.
1	lb. of water raised 1° F. 63° to 64° F.
55	cu. ft. of air 1° F. (approx.)
1	cu. ft. of air 55° F. (approx.)
1/250 of	1 sq. ft. of steam radiator surface, (approx.)
1/150 of	1 sq. ft. of hot water radiator (approx.)
1/400 of	1 sq. ft. of steam pipe coil (approx.)
0.12 of	1 gal. of water raised 1° F.
0.252	calories.

result multiplied by 1⅓, will give the engine horsepower. See Table I—(D).

SIZING THE BOILER.

The *rated boiler horsepower* is obtained by dividing the total steam required per hour by 30 or

$$B.\ Hp. = W/30 \qquad (4)$$

When B. Hp. is the boiler horsepower
W is the total weight of steam required per hour at maximum load.

The *heating surface* required in the boiler is

$$HS = 10\ B.\ Hp. \qquad (5)$$

when HS is the heating surface in square feet.
B. Hp. is the rated boiler horsepower.

The *grate surface* under ordinary conditions will be

$$G = C \times B.\ Hp. \qquad (6)$$

When G is area of grate in square feet.
B. Hp. is rated boiler horsepower.
C a constant ranging from 0.7 on small boilers to 0.3 on large boilers.

$$G = \frac{5 \times B.\ Hp.}{lbs.} \qquad (7)$$

when lbs. are the pounds of coal burned per square foot of grate.

The *coal* may be approximated by the formula:

$$L = 5\ B.\ Hp. \qquad (8)$$

when L is the total coal required in pounds.

The *number* of boiler units should equal N+1 when N is 6, or less, and N+2 when N is between 6 and 12. N is the number of boilers actually required to carry the maximum load as determined from the formula:

$$N = \frac{TL}{30\ Hp. \times \%} \qquad (9)$$

when N is the number of active units required.
TL is the total load in pounds of steam per hour.
H. P. the nominal boiler rating.
30 the pounds of water evaporated per hour.
% the per cent of rating at which boiler is to operate.

Then when N is 6 or less, the total number of units should be

$$N + 1 \qquad (10)$$

and when N is 7 to 12 the total number of units should be

$$N + 2 \qquad (11)$$

For *forced draft* the air required is 250 cu. ft. per pound of fuel burned. Then the total air per minute will be

$$CFM = PC \times 250 \qquad (12)$$

when CFM is cubic feet of air
PC is pounds of coal per minute.

If *coal handing equipment* is to be installed it should be able to at least handle the plants daily supply in four hours or its capacity will be

$$C = \frac{Av.PC \times 24}{4} \qquad (13)$$

When C is capacity of coal handling equipment in pounds of coal per hour.
Av. PC is average pounds of coal burned per hour through the day and night.
24 the number of hours per day.
4 the number of hours in which the coal is handled.

DRAFT AND CHIMNEY DATA.

The *draft* will have to equal the losses of furnace, boiler, flue and chimney; these will run from ¾-in. to 1½-in. of water according to coal, horsepower developed, etc. (See Data Sheets No. 100 series THE HEATING AND VENTILATING MAGAZINE for October and November, 1917.)

The *height of the chimney* will have to be sufficient to overcome all draft losses as outlined in the same Data Sheets.

The area of the chimney will be

$$B.\ Hp. = 3.33\ (A - 0.6 \times \sqrt{A})\ \sqrt{H}. \qquad (14)$$

when B. Hp. is the rated horsepower of the boilers.
A is the area of the stack in square feet.
H is the height of the stack in feet.

This formula, worked out in the form of a table, can be found in many hand books or Data Sheets of No. 100 Series may be used.

COMPUTING CONDENSING DATA.

If the plant is to be run condensing—a rather unusual condition for small plants of this kind—the *condenser water* per pound of steam condensed may be computed for 90% dry steam by

$$W = 940/R \qquad (15)$$

Where R is the raise of the condensing water in degrees.
W is the water in pounds per pound of steam condensed.

The temperature rise is computed by taking a temperature of the outgoing water of at least 5° lower than the steam temperature at the vacuum under which condensing takes place, from which is subtracted the maximum temperature of the incoming water, the difference being R or the rise. For instance, for 28-in. vacuum and 26° rise, the pounds of condensing water per pound of steam supplied to the engine or turbine is

940/26 = 36 lbs. of water.

The *total condensing water* will equal

$$W = w \times L \qquad (16)$$

when W is the total condensing water required in pounds per hour.
w is the condensing water per pound of steam.
L is the total pounds of steam per hour to be condensed.

If the condenser water is to be carried in *flumes*, a velocity of about 200 ft. per minute is allowable and the flume area will be

$$A = \frac{W}{60 \times 62.5 \times 200} \qquad (17)$$

when A is area of flume in square feet.
W the total weight of condenser water in pounds per hour.

FEED-WATER HEATERS.

The feed-water heater (open type) should have a horsepower rating at least equal to the total actual boiler horsepower to be developed, or, better, should slightly exceed this.

BOILER-FEED PUMPS.

The *boiler-feed pumps* in number will be

$$N + 1, \qquad (18)$$

when N = number of active units.
and N = 1 for small plant or
N = 2 for medium and large plants.

The *capacity of the boiler-feed pumps* must be

$$GPM = \frac{TPS}{N \times 60 \times 8\frac{1}{3}} \qquad (19)$$

when GPM is gallons per minute.
N the number of active units.
TPS the total pounds of steam developed per hour.
60 is the number of minutes in an hour.
8⅓ is the number of pounds per gallon of water.

The *size of boiler-feed pumps* can be taken directly from catalogs, if they are rated in gallons per minute, but, if desired to check capacity, a piston speed of 50 ft. per minute may be used with a displacement efficiency of 90%.

Then for a *simple* pump

$$D = \frac{TPS}{N \times 60 \times 62\frac{1}{2}} \qquad (20)$$

And for a *duplex* pump

$$2D = \frac{TPS}{N \times 60} \qquad (21)$$

When D is the theoretical displacement of piston.
TPS total steam in pounds per hour.
60 number of minutes in an hour.
62½ weight of one cubic foot of water.

D is easily computed

$$D = 50\ Pa. \qquad (22)$$

When Pa is the pump piston area in square feet.

STEAM, EXHAUST AND BOILER-FEED PIPING.

Steam and exhaust pipes may be designed for velocities of 10,000 ft. per minute for constant flow or about 1.2 of this for intermittent flow, such as to reciprocating engines, etc.

For *boiler-feed pipes* and other water lines it is customary to allow a water velocity of 200 to 300 ft. per minute.

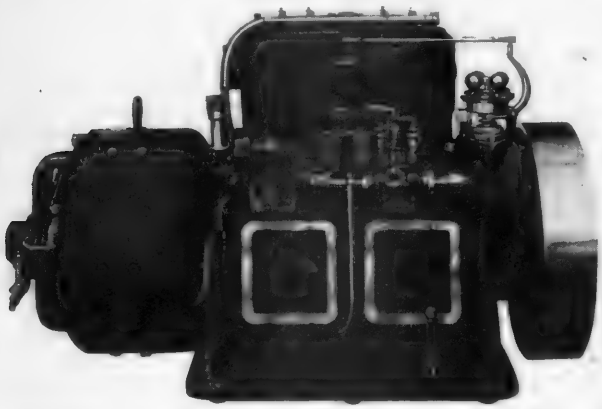
NOTES

There are instances in the life of a small building power plant when it may not be economical or desirable to start up the whole installation in order to supply a few lights or one or two small motors. There are also other occasions where the cost of outside current for breakdown service is made exorbitantly high so that the small plant will either prove too expensive to install (including the cost of additional units for emergency use) or else will cost too much to operate when including the cost of breakdown service.

In either case one solution, which is not at all impractical and which has already been adopted by some smaller plants, consists in the putting in of a gasoline engine-

driven generator set of sufficient size to carry over the emergency.

The B. F. Sturtevant Company, Boston, Mass., makes generator sets of this type, one of which is shown in the accompanying illustration. The engine is of the four-cycle, water-cooled, vertical type, with four



STURTEVANT GASOLINE ENGINE-DRIVEN GENERATOR SET.

or six cylinders, according to the size. Stock sets come in three standard sizes of 5, 10 and 15 K. W. capacity and can carry an overload of 25% for two hours.

According to a test made on a 10-Kw. unit, its thermal efficiency at full load is nearly 16% and its fuel consumption about 1.75 pints of gasoline per kilowatt hour. At half load the thermal efficiency drops to a trifle over 11% and the gasoline increases to about 2 5/8 pints per kilowatt hour.

Fuel Conservation as a Permanent Movement.

In a recent address by David Moffat Myers, advisory engineer to the United States Fuel Administration, before the Boston section of the mechanical engineers' society, he stated that letters are being received in Washington from far and wide asking that some scheme of fuel conservation applicable to power plants be adopted as a permanent measure. Many manufacturers, he stated, have written appreciatively of the saving they have been able to effect as a result of instruction received from the volunteer inspectors of the fuel administration, or from the standard recommendations of the administration.

From the beginning of the campaign it has been in the minds of engineers that a second phase of the power-plant program might soon become appropriate. The efficiency of any process such as they production of energy is equal to the efficiency of operation multiplied by the efficiency of the equipment. That is to say, the efficiency of the man multiplied by the efficiency of the machine.

The general idea is to formulate what might be termed "A Ten Commandments of Power-Plant Design," treating only of fundamentals and not of specific design. The reason for desiring such a measure is obvious to any engineer. Time and time again we have all seen so-called "improvements" installed by manufacturers using steam-consuming or steam-generating equipment entirely unsuited to the conditions under which they are to be used. When this is done it means that for years and years to come an entirely unnecessary waste of fuel will continue owing to an ill-advised installation.

Mr. Myers told what had been done or was contemplated in issuing bulletins and moving-picture films for instruction purposes. A 50-minute film showing good and bad operation in boiler plants had been prepared, and nine engineering bulletins were announced, some of which are reviewed on another page of this issue.

The Greatest Heating Plant in the World.

In considering the mammoth engineering feats accomplished during the war it is not entirely safe to say that this undertaking or that is "the largest of its kind in the world," but, so far, no exception has been taken to the claim that the United States Naval Station, at Great Lakes, Ill., is entitled to that distinction, so far as its mechanical equipment is concerned.

At the time the hostilities began between the United States and Germany, there were less than 2000 officers and enlisted men at Great Lakes Naval Station. The area then covered by the station was 167 acres, with 90 buildings. To-day the station occupies 1210 acres, with 950 buildings, capable of housing 10,000 more men than there were in the entire United States Navy in 1915.

There have been trained and sent to sea from this station approximately 120,000 men, an average of about 6,000 per month since war was declared.

The heating and service equipment is distributed among 17 groups of camps,

mess halls, aviation and officer material schools and hospitals, all within the corporate limits of the station. A corps of approximately 1400 men of the public works department are attached to the various boiler plants at the station. They work in eight-hour shifts, 24 hours.

There are installed at the station 190 fire-box boilers of Kewanee make, 35 smokeless down-draft and 155 regular updraft. These boilers have a rating of 22,362 nominal horse-power, an average of 117 H. P. per boiler. The coal consumption is nearly 1000 tons per day, with a generation of about 630,000 lbs. of steam per hour. The total length of these boilers, if set end on end, would be 3765 ft., or, if set closely side by side, the battery would have a frontage of 984 ft.

The 190 boilers have a combined radiator rating of 2,261,580 sq. ft., an average of 11,900 sq. ft. per boiler, or a total of about 400 large carloads of radiators.

As a problem in mathematics, it has been figured that the size boiler that would be required to take care of this amount of radiation would have to comply with the following specifications: Diameter, 67 ft.; length, 298 ft.; tubes, 104, each 34 in. in diameter and 217 ft. long; fire-box, 76 ft. long, equipped with 4712 sq. ft. of rocking grates; boiler heating surface, 224,380 sq. ft.; main supply flange, 98 in. in diameter; return flange 73 in.; safety valve flange 49 in.; direct radiator capacity of boiler, 2,261,580 sq. ft. The boiler would require a smoke stack 32 ft. in diameter and 1250 ft. high, with 17,500 ft. of guy rope. Estimated size of steam gauge, 84 in. in diameter. Cost, about $500,000.

Suggestions of Public Service Commission for Improving Service and Handling Complaints.

Something out of the ordinary in the procedure of a public service commission, showing a helpful attitude that will be appreciated by the utility companies, is the publication of the Illinois Public Utilities Commission of a circular letter to the public service companies of the State, relating to service rendered and the handling of complaints. The leter states that as a result of the commission's experience, covering a period of five years, it has become strongly impressed with the large influence which the quality of service rendered and the methods of handling complaints has upon the public.

The circular letter then calls attention to the lower standard of service prevailing during the stress of recent times and recommends that such a practice is most unwise where it can be avoided, and then instead of relieving the utility of its burdens, it will greatly increase them.

Through the handling of complaints, it is pointed out by the commission, most utilities find their only opportunity of meeting their consumers. This, it is declared, is unfortunate, because the utility gains its impression of its consumers through these complaints. If the utility is willing to accord to each complaint an individuality and give it a just investigation, the complainant is well satisfied, and, as the result of his contact with the company, has an appreciation of its human characteristics and a regard for its sincerity of purpose.

"We believe," continues the letter, "that much of the criticism directed against utilities and which, in a certain measure, reacts against the regulatory bodies charged with their supervision, might be relieved by a broad-minded policy of handling complaints, in which each case is treated as an opportunity for acquaintanceship with the consumer and each complaint is given an individuality and impartially investigated."

The letter is sent out over the signature of Frank G. Ewald, chief engineer for the commission.

New Tests on Deoxidization of Hot Water to Prevent Pipe Corrosion.

Our readers are no doubt aware of the method developed by the National Tube Company, and known as the Speller deoxidizing process, for the treatment of hot water to prevent corrosion of the piping. The method iteslf was described in papers read before the heating engineers' society in 1917 and 1918 and consists briefly in removing the oxygen from the water through the use of Cambridge metal lath strips, or other suitable form of sheet iron, in the hot water chamber. This is based on the theory that by keeping hot water under pressure in contact with a large surface of iron for a sufficient length of time, it is possible to remove and "fix" the oxygen. This process serves to render the water practically inactive or non-corrosive.

At the last annual meeting of the heating engineers, Frank N. Speller, metallurgical engineer for the National Tube Company, and the originator of the process, told of further tests of the piping in the Irene Kaufmann Settlement installation which, as he described in his previous paper, is equipped with a deoxidizing apparatus.

The new data refer to the test pipe in-

stalled two years ago, using deoxidized water, which has now been re-examined.

The pipe was made up of two 29-in. lengths each of 2-in. uncoated black steel pipe and 2-in. wrought-iron uncoated black pipe. The two lengths showed the same soft black coating which had been observed in the previous examination, but there was no evidence of pitting, even where the steel pipe was in contact with a brass union, a condition favorable to rapid corrosion by electrolytic action.

The plant in question has now been in use continuously for over three years and it has not been necessary in that time to renew the deoxidizing plates in the hot water tank or the filter material, while the analysis of the water shows the same percentage of oxygen removal as was found when the plant was installed.

The Cost of Coal for Generating Steam.

The accompanying diagram furnishes the power plant operator accurate information on the cost of coal for generating steam. Knowing the price, and the amount of coal burned and the quantity of water evaporated the solution is easy. Start with the cost of coal per ton and project vertically, intersecting the oblique line corresponding to the evaporation from and at 212° F. being obtained from the boilers, then move horizontally to the left margin, where the cost of coal to evaporate 1000 lbs of water from and at 212° F. is given. The chart can also be used to determine the evaporation required to generate steam at a certain cost, by reversing the above process.

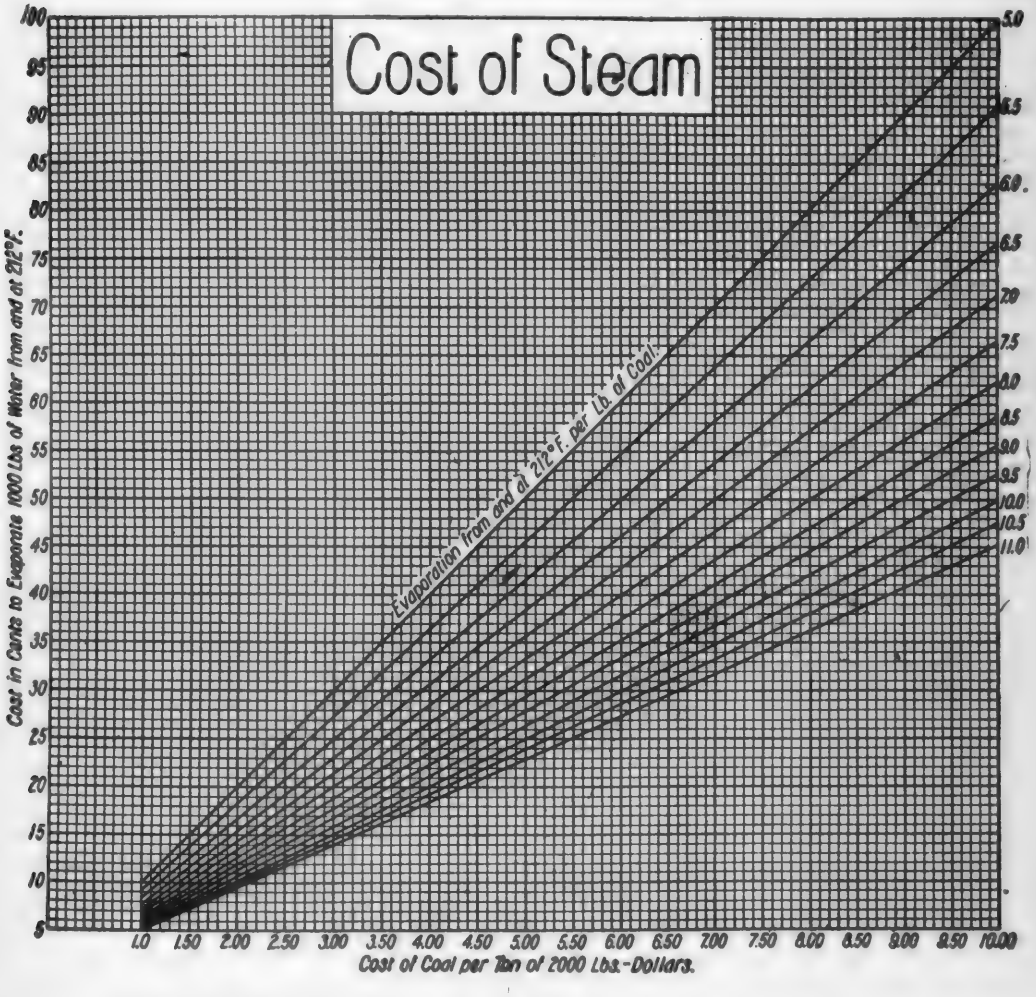


CHART SHOWING COST OF STEAM WITH VARIOUS COAL PRICES.

THE RECONSTRUCTION ERA

The Manufacturer's Wage Problem.

Salient thoughts, expressed by Herbert F. Perkins of the International Harvester Company in a recent address before the Union League Club of Chicago, are given in the following extracts from his address:

The manufacturer of the United States is emerging from a period of intensive effort, accompanied by a constantly-increasing cost of production, due to mounting material prices and labor rates. Higher cost of production, translated into commodity prices, has immediately been reflected in the living cost of the wage-earning classes. It is evident that in proportion as living costs have advanced without a corresponding advance in the standard of living, increased wages have been purely an increase in dollar wages, but not in actual prosperity.

Today the manufacturer of the United States faces a serious and uncertain future. He knows that for a year and a half to come the price of wheat has been guaranteed at the highest war price. He understands that his country, owing to the demoralized condition in other great food producing nations, is expected to protect food shortage in Europe and he therefore has reason to expect that foodstuffs generally will be in unprecedented demand, so that although the food requirements of armies is materially greater than the food requirements of the same population when returned to civil life, the cost of food in the workman's budget will continue at a high level for an extended period.

Too many employers, with their minds more on the experience of the past than the promise of the future, have been watching anxiously and often nervously the constant rise in money wages. The thought has been borne strongly in upon them that the historical and therefore the most natural and correct method of meeting the period of declining business and profits is through the prompt reduction of the wage rate attained through the stimulation of these past years of conflict.

HOME MARKETS MOST IMPORTANT.

There are, in the United States, more than thirty million people largely dependent upon fixed compensation; and of these the wage-earners in our factories, offices, mills and mines are the largest single group. It would follow that the prosperity of our home market and consequently the prosperity of the manufacturers of America depends upon the buying capacity of the wage-earners of this country in a degree that we have not been wont to measure adequately.

So it is hard to believe that in moments of sober reflection the manfacturer of America will begrudge for the wage-earners of America the considerable gain that has accrued to at least a very large number of them and their families through their increased income above the actual advance in cost of living during the period of the war.

FOOD MUST DECLINE BEFORE WAGES.

When the prices of foodstuffs shall have fallen by the removal of artificial props and through the returned productivity of various lands at present either wasted by war or handicapped through shortage of laborers or through unwillingness to toil; when abnormal profits and wasteful methods incident to the period of the war have been eliminated; and when, through a closer co-operation between management and wage-earners, the possibilities of increased production have been secured, the elements that go to make the wage-earner's budget will show an appreciable decrease. Then—and not until then—regulated by the maintenance of general and not class prosperity, should adjustments in wage rates be attempted on the basis of the buying value of the dollar.

If the worst comes and, through the pressure of competition from abroad, it becomes evident that with all other resources exhausted, general employment and consequently general prosperity can only be maintained by a decline in commodity wage, such further adjustment must necessarily follow.

It is necessary to emphasize that until all other expedients are exhausted, the policy of forcing a lower standard of living by reduction of the money wage, while living costs are still approximately at their peak, or at any time to reduce the commodity wage, particularly to do so by arbitrary discharge and rehiring or any of

the other discredited methods which have at times been more or less common, would be the veriest exhibition of not only injustice, but of folly. It would surely be accompanied by hostility on the part of the great wage-earning community, as well as on the part of the clear-thinking men in the community at large; would be the surest way to increase the power of the demagogue, whether he be politician or unprincipled labor leader; would widen the unfortunate cleavage, which we should be mending instead of spreading, between wage-earners and management; and, at the present crisis when the influenza of Bolshevism is abroad in the world, it would undoubtedly rapidly spread this disease in our own country. It would, in short, be bad morals and bad business.

Employment Exchange for Engineers and Other Technical Men.

For the first time in the history of America's development employers have an opportunity of selecting from a large and varied list of highly educated and experienced men those individuals especially equipped to meet their particular requirements.

Engineers, executives, men of college training and practical experience in business and technical fields are now being released from the Army, Navy and from war work. The Profession and Special Section of the U. S. Employment Service, a branch of the Department of Labor, has been organized for the benefit of employers in need of these men. The service is entirely free of charge.

I. W. Litchfield, the head of the Professional and Special Section, was one of the organizers and directors of the U. S. Public Service Reserve, which supplied engineers and business men to the government for war work.

The U. S. Employment Service is now divided into two great zones for the purposes of the Professional and Special Section. The New York office, headquarters for the Eastern Zone, at 16 East 42nd Street, is in charge of the following states: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Ohio, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida and Alabama.

The Chicago office, headquarters for the Central Zone, at 63 East Adams Street, is in charge of all remaining states. Later zone offices will be established to take charge of part of the territory now in the Chicago zone.

The United Engineering Societies, composed of the four great engineering organizations are now co-operating with the Professional and Special Section in placing men in the engineering professions.

Immediate Resumption of Building Activities as a National Asset.

"The main issue now before our country," states F. T. Miller, director of the Division of Public Works and Construction Development, Department of Labor, "is, are we in a state of liquidation, trying to settle up our affairs, or are we a going concern?"

He then points out that this country has $265,000,000,000 of wealth, wealthier than four of the wealthiest nations of the world combined. We also have $2,500,000,000 worth of gold in this country, the greatest amount ever known in the possession of this country, and considerably more than half of the gold of the world.

"Because of a psychological status," he continues, "everybody is waiting to see if somebody else is going to reduce his price on something."

In its effort to stimulate local and private initiative in the industrial readjustment, the Department of Labor is supporting and co-operating with many governors and mayors. In North Dakota, Governor Frazier proposes "a permanent industrial commission to undertake a programme of public works and of State industries, together with a special drive for home building and farm improvement." In all States where legislatures now are in session, the subject of expediting public work and encouraging private building is being discussed, special attention being given to the possibilities of this public work as a stimulus to industry and its effect on the labor situation.

More than 500 opinions have been received recently by the Information and Education Service of the Department of Labor, on the question of "What is holding back building and construction work?" Many building authorities blame Congress, others charge the financial interests of the country with the responsibility. In the central west, freight rates are said to be exerting an injurious influence. In the main, high costs of material are held to be the chief obstacle.

"Don't expect private capital to build merely for the sake of furnishing jobs for workmen," writes a well-known architect from Buffalo. "That is the obligation of the government, be it local, state or national. Let public works be started at once for the benefit of the public. The

cost will be high and the public will have to pay the price, but the public will reap the benefits of the reduction of unemployment, the absorption of the products of many industries and the use of many works of which there is great need."

Labor conditions and demands are held to be unfavorable to immediate building operations by many of the authorities writing to the Information and Education Service. An architect, writing from Lincoln, Nebr., makes the following statement, typical of the complaints along this line:

"Construction work in these parts is now and has been impeded not a little due to the unreasonable demands of labor not only for exorbitant wages, but more by the fact certain very undesirable trade rules are being enforced by labor organizations, which run up the cost of doing work enormously."

Many of the contractors and builders in the central west assert freight rates are the chief trouble.

Lack of co-operation on the part of financial interests seems to be the outstanding obstacle in New York. One of the best authorities on the building industry in New York City sums up the situation there in this fashion:

"We have in the United States serious difficulty owing, principally, to the unwillingness of financial interests to co-operate in building projects with the material and labor market in its present condition. We are working on a total of nine industrial projects involving approximately 6,000 workmen's homes, to be carried out by private interests in various important industrial centers, but in each case we are hampered by the building loan situation."

From St. Louis, Mo., a well-known architect writes: "I am firmly convinced that the one thing the building public wants to know is the cost of building today as compared to the next three to five years. If they could be assured that the cost will not drop within that time, there would be a tendency to proceed with the needed work."

Many eminent building and material authorities, insist that no marked decrease in material prices may be expected for the next five years. They assert with some positiveness that pre-war prices on building materials will not be reestablished for several years, if ever. These assert that persons who delay building in the hope of marked reductions in building costs probably will be disappointed and will have denied themselves the use of needed property and the revenues which would be derived therefrom.

Indiana is preparing to fight both radicalism and unemployment through a home-building and home-owning campaign. This campaign is being pushed by the U. S. League of Building and Loan Associations. It is estimated that it will take approximately $500,000,000 expended in buildings in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and New York to make up the building deficiency incident to the war. This construction work must be in addition to the normal, current requirements of 1919. These figures are based on the results of a study of building needs in these six States made by the Economics Section of the Division of Public Works and Construction Developments. Taking the building permits issued in 1914, 1915 and 1916 to obtain an average representative of the normal year's requirements, and comparing this average with the permits actually issued during the war years of 1917 and 1918, it has been possible to establish the actual reductions in buildings in 21 cities.

Opportunities for Disabled Soldiers.

A call has been sent out by the Federal Board of Vocational Education at Washington to patriotic individuals all over the country asking assistance in getting the board in touch with returned soldiers who have been disabled, but who are making an attempt to work at some occupation, and are not succeeding well. The Federal Board offers to these men the choice of over 400 trades.

In this connection Douglas C. McMurtrie, director of the Red Cross Institute for Crippled and Disabled Men, says:

In the past, our method of dealing with the man permanently disabled in the course of employment has been to pay the worker a pension in the form of compensation, and forget him and his injury. But the cost of disability to has not been alone in the premiums paid for casualty insurance. There has been the cost involved in the training experience, and adaptation of a skilled worker who does not return to his job, and the fitting of a newcomer to take his place.

"We are now rapidly coming to the plan of rehabilitating the worker, where that is possible, for self-support. The science of rehabilitation is new, and the experience in it has practically all been gained in the effort to make sound and just provision for the disabled soldier or sailor. Every country among the recent belligerents is to-day operating a comprehensive system

of re-education for disabled soldiers, and is placing upon that system more dependence than upon the pension system.

"The first aim in dealing with such disabled men is to place them back in different jobs in their own trade or in a trade closely related. In such jobs their past experience will stand them in good stead. Failing this, they can be re-trained for a different line. Needless to say, the cost of soldier rehabilitation is being met by the United States government and by the governments of some of our allies."

Proposal for Immediate Revision of Anti-Trust Legislation.

A recommendation that Congress give especial attention to the Sherman and Clayton Acts, with a view to their immediate revision, has been put by the Chamber of Commerce of the United States to a referendum vote of its membership. The proposals to be voted on are four in number and they are the results of a special study of the situation made by the Chamber's Federal Trade Committee. They follow:

The committee recommends that Congress should at once consider the situation of all statutes constituting our anti-trust legislation.

The committee recommends that there should be formulated standards of general business conduct to be administered by a supervisory body.

The committee recommends than an enlarged Federal Trade Commission should be made the supervisory body. The committee that the membership of the Federal Trade Commission should be increased fom five to nine.

The report of the committee after calling attention to a resolution adopted at the annual meeting of the Chamber in April, 1918, which proposed that in view of the economic policies inaugurated during the war Congress should be asked to consider a revision of anti-trust legislation and of the Trade Commission Act for the purpose of amending or replacing them in such manner as to make this legislation reasonable, clear and adequate, points out that the present time is particularly opportune for remaking the laws.

Architects Outline Programme for Post-War Conditions.

Interesting reading for the engineer and contractor is contained in the tentative programme proposed by the Post-War Committee of the American Institute of Architects, regarding improvements which will affect the conditions and increase the efficiency and adequacy of architectural practice throughout the United States. The principal points brought out in the report are presented herewith:

THE STATUS OF THE ARCHITECT.

It is obvious that the status of the architect in the modern world is established for him (and not by him) as a result of the necessity for, and the value of, the service he renders. The main objective in any building operation is a completed structure serving adequately the purpose for which it is intended, measured in terms of appearance, utility and durability. More and more we hear it said that despite these facts, architects are so tenacious of their professional ideals that they are inclined to disclaim any relation to ordinary business or industry and their responsibilities.

NEED FOR MORE COMPREHENSIVE SERVICE.

The modern tendency of business, accented by the experience of the war, is to deal with larger organizations with one responsible head rather than with the several contributing factors that go to make up an organization to produce a material result. It is said that the architect has done nothing to meet this demand, but that engineers have, to an extent, done so.

The war has brought the whole world face to face with a situation which demands that production be increased and that resources and facilities be developed to an extent far exceeding the pre-war volume. The architect is said to have done nothing to co-ordinate his work with the movement for efficiency in production.

BUSINESS OR PROFESSION.

The claim is made that architects have persistently defined their services as distinctly professional, while in rendering a large part of their service, they really are business men. The existing American tendency is to measure the value of all effort by material performance—statistics as to costs, quantities, speeds, and mechanical achievements—which by comparison have a dramatic appeal. The public has no measure of value for the more subtle service that, through the exercise of imagination and creative genius, makes these physical accomplishments possible.

Architects who have employed direct business methods, even to the point of be coming contractors, seem to have made a better understood appeal to the public, fre-

quently to the detriment of good architecture. Something must be done to preserve both valuable elements.

THE PURPOSE OF PROFESSIONAL ORGANIZATION.

Our professional organizations are said to have occupied their energies in the past in prescribing the exact terms upon which an architect may seek or accept employment and have not taken into account sufficiently the kind and quality of service the public demands and is willing to pay for, or the terms upon which the public is willing to engage such service under the everchanging economic conditions that govern all business operations.

RESPONSIBILITY.

A large proportion of building is carried on with borrowed funds. A reliable estimate of the cost of the completed structure is necessary as a prerequisite in arranging any scheme for financing its cost. Individuals are entitled to know in advance, approximately, what obligations they are entering into. Too many architects have been slow in realizing how vital is a reliable preliminary estimate in the success of a building undertaking.

An architect's estimate, even though correct, carries with it no financial guarantee that protects the owners or lenders in the amount of money they may be called upon to spend. The architect's status as agent of the owner imposes upon the owner full financial responsibility for all errors of judgment or defects growing out of lack of experience or ability on the part of the architect, except in such remote cases where it can be proved that the architect has failed to exercise due diligence and care. The architect's status is said to be not clearly enough professional, in the lay mind, to make apparent the reasonableness of this relation.

THE CONTRACTOR'S FUNCTION.

Great changes have taken place, in recent years, in the status of the contractor in relation to building enterprises. In important work the contractor, now generally, sells his services on a professional basis. His remuneration is understood to be for the use of his organization and its knowledge of the building business. This changes the relation of the architect to the whole building procedure.

The contractors have been quick to realize changed conditions and the desire of modern business to deal with one organization equipped to handle all phases of a building problem. Construction companies are therefore employing able designers and doing all work from the making of drawings and specifications to the financing, building, and furnishing of the structure. Under this new system, the average architectural organization dwindles in impressiveness. The service of an architect, where a contractor is slected on the basis of "confidence," is not required in the same degree as in the older method, to watch the performance of the contractor or to safeguard the expenditures of the owner. Nor is he so frequently called upon to adjudicate disputes that may arise between the owner and the contractor over interpretations of the contract obligations.

Organization for Disposal of Surplus War Materials.

Details of the plan of organization of the Office of Director of Sales of the War Department are given in a bulletin put out by the War Service Executive Committee of American Industries to members of the 400 War Service Committees organized under direction of the Chamber of Commerce of the United States.

Under the Director of Sales, C. W. Hare, is an assistant, E. C. Morse, who serves as chairman of the Board of Sales Review comprising the following members besides Mr. Morse: Lt. Col. A. LaMar, Maj. W. M. Crunden, Col. Fred Glover, L. H. Hartman, G. F. Woods, Capt. A. L. Mercer, Capt. T. S. Schultz. Each of these members of the board is a Division Sales Manager with the exception of Capt. Schultz, who is legal member on the board.

The class of materials to be handled by each of the division heads is as follows:

Colonel LaMar: Machine tools, including all metal and woodworking tools, railway equipment, steam shovels, locomotive cranes, gantry cranes, hand tools, forging equipment, iron and structural workers power tools and machinery.

Major Crunden: Building material, including lumber, millwork, fire protection, water supply, fabricated steel, roofing, wall board, paints, refrigeration, hardware, brick cement, heating, machine equipment, electrical equipment.

Captain Glover: Trucks and motor equipment, including trucks, motors, motor cycles, side cars and all surplus supplies and repair parts pertaining thereto, animal and hand drawn vehicles.

Mr. Hartman: Quartermaster stores, including food, clothing, furniture, all issue materials, cotton linters, leather goods, rubber goods, rope, silk cloth chain, linen, thermometers, clocks, etc., optical glass,

paints, gasolene, barbed wire, wire netting, garment workers, cobblers and saddlers tools, cots, soap, horses and mules.

Mr. Woods: Real Estate.

Captain Mercer: Raw materials, including pig iron, lead, brass, copper, steel ingot, platinum, nitrates, pig tin, manganese, chrome, ferro alloys, mica, liquid chlorine, mercury, nickel, non-ferrous metals, acids, chemicals.

(To be named): Ordnance supplies, including artillery, guns, small arms, all manufactured munitions, powder, explosives.

MODERN PRACTICE IN VAPOR HEATING

IX.—The Mouat-Squires System.

Editor's Note.—*For the purpose of this series of articles, a vapor, vacuum, vapor-vacuum, vacuum-vapor, atmospheric, modulated or therograde system of heating will be considered as any system in which the steam pressure ordinarily carried is practically at atmosphere or slightly below or in which the returns are open to the atmosphere and where no pump or other positive mechanical device is employed to pull back the returns.*

The Mouat vapor system, as developed by the Mouat-Squires Co., Cleveland, O., is an open return system, the general arrangement of a typical layout being as shown in Fig. 1. It will be noted that the steam main is pitched downward in the direction of the flow and has a drip line at the far end. This drip drops down under the water line and comes back to the boiler as a wet return, entering the boiler through a check valve.

The return main pitches down toward the boiler and has an air vent pipe connected to it at the point where it drops under the water line. This air vent is run to the chimney flue so that the draft suction will help to keep the system relieved of air.

The return then drops under the water line and enters the boiler through a check valve.

The radiators are of the water type and employ a modulating valve on the supply

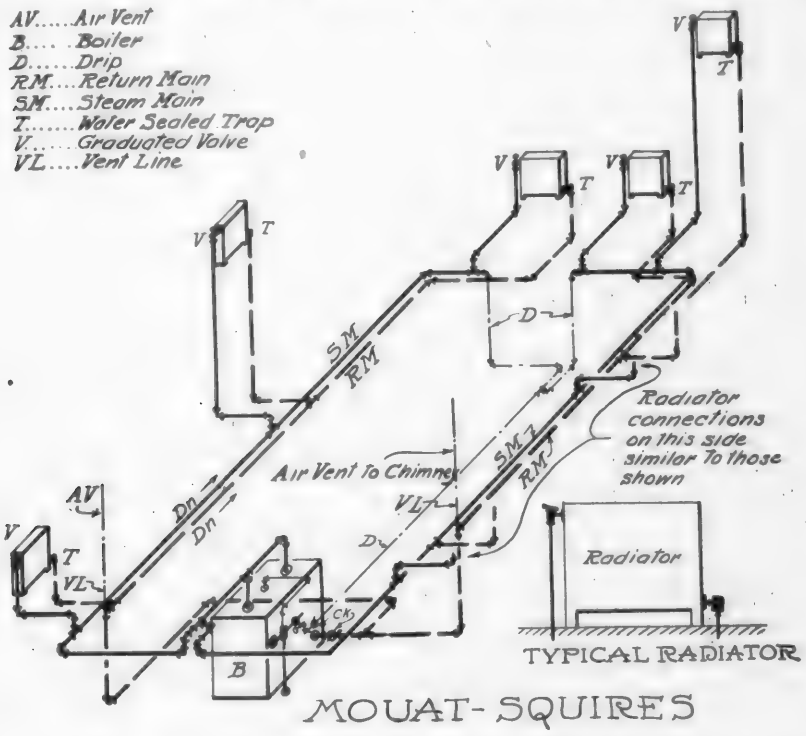


FIG. 1—TYPICAL LAYOUT OF MOUAT-SQUIRES SYSTEM.

end. They are increased slightly to prevent the steam getting into the return lines. To offer further hindrance, a water-seal trap is installed on the return end of each radiator. These traps are shown in detail in Fig. 2 and consist of a chamber divided off so as to maintain a water seal on one side of the interior partitions while the air passes over into the other side through a small vent hole. In the bottom of the water chamber is a small drip hole which allows the water seal to slowly drain out. Of course where the radiator is working the water seal is replentished faster than it drains off, but when the radiator is shut off it takes only a short time to drain out the seal and thus prevent freezing.

No automatic device is used to return the water against the boiler pressure and for this reason the boiler pressure carried depends on the vertical height in which the water may back up in the vertical return pipe without flooding the horizontal return main.

The damper control for this system, although entirely distinct from the return line, is unique enough to deserve special mention. A diagram of a typical application of this regulator to an ordinary small boiler is shown in Fig. 3 and the explanation of its action is as follows:

The stationary tank A is supported on a pipe column from the floor and is filled with water until it overflows through the ¾-in. overflow connection to the boiler shown. A second tank F is placed at the

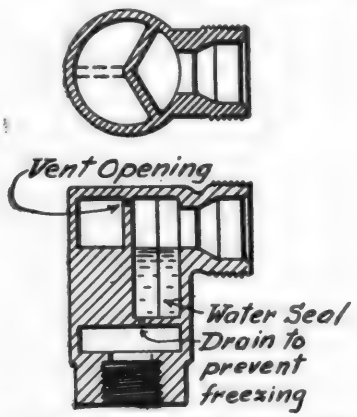


FIG. 2—WATER-SEALED TRAP USED ON RETURN END OF RADIATOR.

extreme of the lever arm C. This lever arm is formed of common iron pipe, the opening in which connects with the chamber F on one end and with flexible hose B at the fulcrum. The hose connects at the bottom to the stationary tank A. The action of the apparatus results from the generation of any pressure by the boiler, this pressure driving the vapor into chamber A through the steam connection to the regulator. In admitting this vapor, part of the water is driven up the flexible hose and out the hollow arm to the chamber F where it is retained, increasing the weight of this chamber sufficiently to lift the counterweight E and close the drafts. On the falling of the pressure the water flows back out of F and reduces its weight sufficiently so that the counterweight E can no longer

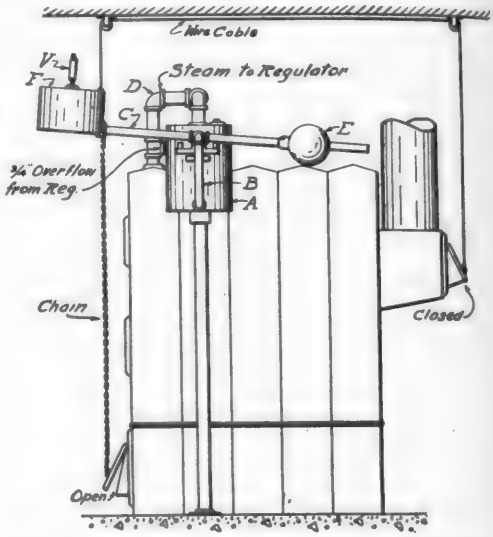


FIG. 3—APPLICATION OF MOUAT-SQUIRES DAMPER REGULATOR.

be held in its elevated position and it falls, thus reversing the drafts.

The setting of the counterweight E will allow this action to take place at any reasonable desired vapor pressure and the flow of water into and out of chamber F is made possible by the admission and release of air to and from the chamber through the vent valve V.

"Own Your Home" Exposition to be Held in Philadelphia.

The first "Own Your Home" Exposition ever planned will be held during the week of April 21-26, 1919, at the First Regiment Armory, Philadelphia, under the auspices of the Philadelphia Real Estate Board. The exhibits will include everything that enters into the building and furnishing of a home. Ernest H. Crowhurst is the general manager of the exposition, with offices at 1126 Walnut St., Philadelphia. The exposition is being planned as the outstanding feature of the "own your home" campaign which the allied business interests of Philadelphia is planning to launch at that time.

LEGAL DECISIONS

"Satisfactory" Results.

There is a conflict in the authorities as to the meaning of the term "satisfactory," as used in a contract. It is held, perhaps by the weight of authority, that, where this term appears in a contract, the party in whose favor it was reserved has the absolute right to determine the question, and to act accordingly—that is, either accepting or rejecting the work, provided his act is not merely capricious. Other authorities hold that the term is fully met where the work, as done, should be satisfactory to a reasonable man. In arriving at a contract for heating and ventilating equipment the term was made the subject of correspondence between the parties. The seller was very loath to use it, saying that it had had so much trouble with argeements in which this word appeared that it had ceased to admit the term into its contracts. The purchaser insisted, and would sign no other; thereupon the seller yielded. In an action to enforce a lien, the Tennesee Supreme Court held, Peck-Williamson Heating & Ventilating Co. v. McKnight & Mertz, 205 S. W. 419, that the parties must have understood that the purchaser was to have the absolute right to determine for himself whether the work as done effected a result satisfactory to himself. The court thought his determination was not capricious, because he spent an addition sum to improve the heating capacity, although the court found it difficult to decide between the contention of the parties as to the necessity of additional expense.

But is was insisted in behalf of the seller that, inasmuch as the purchaser made no test to ascertain whether the work as done produced the satisfactory results provided for in the contract, and did not call upon and notify the seller with a view to making this test, he waived the right to resist payment. The purchaser insisted that there was no suitable weather to make the test for heat, as the weather did not reach the degree of severity indicated in the contract (zero weather) and this was proven. The purchaser insisted that he was not bound, therefore, to make the test by February 25, 1915, as provided by the contract. So far as he was concerned, this did not seem to have been material, because the heating apparatus proved satisfactory in this respect. The only trouble was with the ventilation. It was shown by the evidence the test for the latter purpose might have been made at any time by the use of an anemometer, but it was not made. It was therefore held that the purchaser waived his right to resist the payment of a proper sum on the ground that the work was not satisfactory.

False Pretense as to Ability to Pay for Goods.

A demurrer to an indictment for obtaining money on false pretenses was sustained under the following circumstances. The defendant, according to the indictment, had a contract with the board of education of Louisville, Ky., for the installation of heating and ventilating apparatus in a school. To carry out this contract he purchased from the prosecuting witness pumps and drip pans of the aggregate value of $280. The false pretense relied on was the statement by the defendant that there was then due him under his contract with the board of education the sum of $5,401, whereas there was due him only $2,865. The false representation in this case was not in writing, and the demurrer to the indictment was sustained on the ground that section 1208, Kentucky Statutes defining the offense of intentionally obtaining money or property by any false pretense or statement, in so far as it relates to a false statement as to financial means or ability to pay, was partially repealed in 1914 by section 1213b, that statute adding the new and inconsistent element that such statement shall be in writing. On appeal the Kentucky Court of Appeals affirmed the judgment, stating, on the authority of People v. Hyatt, 172 N. Y., 187 that the later section "doubtless was dictated by the knowledge that criminal charges of false pretenses are often instituted in reality to compel the payment of debt and are easily fabricated." The effect of both statutes would be that if the false representation relate to one's financial condition or ability to pay, it must be in writing; but, if it relate to any other independent fact, it need not be in writing.—Commonwealth v. Boyd, 205 S. W. 390.

Lien for Heating Supplies Furnished—Express Agreement.

An owner entered into a written contract with a heating contractor whereby the latter was to supply the heating apparatus for thirty-one houses the former was building.

The recorded contract provided that neither the contractor nor anyone else should file liens. The heating contractor purchased material from a dealer in heating supplies. This company made some deliveries, but when their bills were not paid, stopped delivering material. They subsequently resumed deliveries and filed a mechanic's lien for the materials furnished. The evidence was conflicting as to whether the owner had agreed with the company that if it would resume delivering material it might file a lien therefor. The court held, *Loasby* v. *Irvin*, 65 Pa. Superior Ct., 231, that the disputed facts were fairly submitted and the evidence adduced fully warranted the verdict returned by the jury that the owner was not relying on the waiver of liens in the contract with the heating contractor, but directly agreed verbally, as an inducement to get the material for the houses, that the plaintiff should have the right of lien, in default of payment. As the same court held in *Pierce, Butler & Pierce Mfg. Co.* v. *Rogers*, 60 Pa. Superior Ct., 293, where a dealer accepts from a general contractor a proposal for the plumbing and heating of a number of houses, but under an express agreement made with the owner personally that he would pay to the dealer directly for such material, the dealer is a contractor and entitled to file a lien for the material furnished.

Definite Programme Laid Out for Furnace Research Work.

Probably the most ambitious attempt ever made, in connection with warm-air furnace tests, establishing engineering data based upon facts, has been inaugurated at the University of Illinois Experiment Station, at Urbana, Ill. The work has been started at this station in accordance with an agreement reached by the Advisory Committee on Furnace Research of the National Warm Air Heating and Ventilating Association and the Furnace Research staff of the University of Illinois Experiment Station. At a meeting of the research committee and the research staff in December the decision was made to utilize the plant in the mechanical engineering laboratory of the university for the tests, and, at the same time, an outline was drawn up of the plan to be followed.

In a preliminary address, J. M. McHenry, chairman of the Warm Air Heating and Ventilating Association's advisory committee, stated that the manufacturers of furnaces are greatly interested in determining the relative capabilities of the furnaces now on the the market, while engineers, architects and contractors are no less interested in obtaining authoritative data that would make warm air heating an engineering proposition. He spoke of the fact that the manufacturers were underwriting the proposition, but emphasized the point the the investigators would have a free hand in conducting the tests.

It was agreed that the first series of experiments would be made to determine the overall efficiency of the most common type of warm-air furnace, operating under actual conditions of installation, with combustion rates ranging from 4 to 8 lbs.

It was suggested that a stack draft of 2/10 in. inside the stack damper and check be adopted as a standard in the tests. It also was agreed that temperatures of 150° at the register should be the maximum or from 180° to 190° at the bonnet, for rating tests. Tests, however, will also be made under other working conditions.

It was decided to use hard coal for the standard tests for comparisons of furnaces and for the establishment of laws. Performance tests, however, will be made with both hard and soft coal.

The different bases for rating a furnace were discussed, such as the square inch of leader pipe method, the B. T. U. method and the cubic feet of air handled method. The square inch of leader pipe method was decided upon as the most practical for commercial use. This method will be subject to the 2/10 in. draft restriction and the temperature restriction of 150° and 180° F.

A firing period of 6 hours was considered to conform the nearest to actual practice, based on continuous operation.

It was agreed that for standard tests a double casing, with air space and asbestos interlining and no external covering be used.

Commercial sizes of stacks will be used and supplementary tests will be made on various shapes and types of stacks. It was agreed that the area of leaders and stacks for serving first, second and third floors should be such as to give an air distribution as follows: first floor, 50% by weight; second floor, 30%; third floor, 20%; no dampering of leaders or registers to be done in securing this distribution. All registers will be of the side wall type and no floor registers are to be used in the first tests.

The cold air inlet will be of the same area as that of the combined leaders. Special experiments, however, will be made with various proportions of cold air supply.

The actual work connected with the tests will be in charge of Professor Arthur C. Willard, assisted by W. E. Pratt, engineer for the Sill Stove Works, Rochester, N. Y., and others. So far the funds raised by the association, augmented by the funds of the university, amount to over $10,000 for the first year's work. It is expected that the tests will extend over a period of several years.

The auxiliary plant to study sizes, shapes and lengths, etc., of leaders, pipes and fittings, is now erected and these tests are already being made.

The committee of the National Warm Air Heating and Ventilating Association is composed of J. M. McHenry, chairman, manager of the furnace department of the Detroit Stove Works; P. J. Dougherty, heating engineer for the International Heater Company; R. C. Cook, manager of the Chicago branch of the Thatcher Furnace Company; Walter Wimmer, manager of the furnace department of the Wrot Iron Range Co., St. Louis; and E. S. Moncrief, vice-president of the Henry Miller Foundry Co., Cleveland.

English Heating Engineers Compile Rules for Fuel Economy.

An interesting sidelight is thrown on English heating practice by the rules for fuel economy which have been drawn up by the Fuel Economy Committee of the Institution of Heating and Ventilating Engineers and published by the Board of Trade, Coal Mines Department.

The circular starts out by calling attention to the fact that the suspension of hostilities has not materially lessened the acuteness of the position with regard to the coal supplies for domestic heating. The need for conservation of fuel in the national interests, it is stated, is more pressing than ever, while the first call on an increased output is to meet the requirements of national and public utility undertakings.

Under "Best Fuel" it is stated: "Coke is the most economical and most suitable fuel for use in connection with central heating hot water boilers. In addition to being the cheapest all-round fuel for this purpose, the national interest is served in that the valuable by-products are abstracted from raw coal before it is burnt."

Unless the draft is very poor hot water boilers are recommended as burners of household refuse of a combustible nature. This, of course, does not apply to vegetable refuse, suitable for food for animals. The best time to burn the refuse, it is added, is when a slow fire is required. It is recommended the householders keep two bins, one for comparatively dry refuse and the other for such material as common sense indicates as being unfit for combustion.

"Do not use ordinary (bituminous) household coal in house-heating boilers," states the circular, adding, "it cakes the surface of the boiler with soot and is altogether the most unsuitable and uneconomical fuel for use in such boilers. When or where coke is not obtainable, use anthracite. A good mixture is one part of anthracite to two of coke."

Under "Care of Fuel," it is stated: "All fuel should be kept under cover and stored in as dry a condition as possible. Coke absorbs a large amount of water when exposed to the weather. The evaporation of this moisture in the fire-pot of the boiler involves an unnecessary waste of heat."

A novel rule is given for reducing the fire-grate when the rate of fuel consumption exceeds the fuel rations. In such cases, it is suggested that a row of fire bricks be placed at the end of the grate.

Comparative Heat Losses for Concrete and Clay Hollow-Tile Blocks.

A number of tests were conducted at the University of Toronto in order to determine the actual coefficients for heat losses in concrete hollow-tile blocks and clay hollow-tile blocks, this type of building construction having been adopted for a government hospital group in Canada. The following is a summary of the results, so far as they affected this type of construction.

A brick wall is a better insulator than a hollow wall of similar thickness.

A clay hollow-tile wall is better than a concrete-hollow block wall.

A hollow wall built with the webs of the blocks running horizontally is better than one built with the same blocks having the webs vertical.

The heat losses through hollow walls are reduced very considerably when the spaces are filled with a material which, when placed in the wall, form a number of small air spaces separated from each other. For instance, it was found that ordinary pit gravel had practically the same value as an insulating material as mill shavings.

Tarred or asphalted felt, tarred or asphalted papers and heavy waterproof papers are all of great value in reducing heat losses through walls.

Equally good results are obtained by coating the walls with a good coat of a damp-proofing material which completely filled the pores and prevented air leakage through the wall.

Ordinary plaster, even three-coat work, has little practical value as insulating material on a wall.

As the Ontario Government is able to produce hollow-tile blocks very economically at its own clay plant, and as their use has many advantages which offset their disadvantages as a heat insulator, hollow walls were used for the greater part of the building construction. Steps were taken, however, to reduce the heat losses to a point lower than is obtained in general building practice. Paper, damp-proofing materials, cork, mill shavings, etc., were all used, either separately or in combinations, to obtain the results desired in different parts of the buildings.

It was found in these tests, that the usual constants for heat losses of standard brick and concrete construction are practically correct.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

New York Chapter.

A vivid description of the trip to England and through the devastated regions of France, taken by W. W. Macon, former secretary of the heating engineers' society, and now engineering editor of *Iron Age*, in company with a number of other trade journal editors, was the chief item on the programme at the February meeting of the New York Chapter, held at the rooms of the Building Trades Club, February 20. Mr. Macon and his party were the guests of the British government during their entire trip and had opportunities for observation and investigation that have probably not been afforded any other group of civilians during the war. They reached England just before the armistice was signed in November and had the pleasure of inspecting the abandoned German trenches in Flanders very

VIEW IN EAST WING OF BUREAU OF MINES BUILDING, PITTSBURGH, WHERE HEATING ENGINEERS' RESEARCH BUREAU WILL CONDUCT ITS TESTS.

shortly after they were abandoned in the flight towards the Rhine.

Mr. Macon had many stereopticon views which proved of the utmost interest, as did the account of his experiences.

Before he spoke, President P. H. Seward asked the diners to rise in silent tribute to William M. Mackay, the first president of the New York Chapter and for many years secretary of the heating engineers' society, who had died the day before.

During the evening a report was made on the work of the research committee towards procuring the desired number of subscriptions for the support of the bureau of research. Mr. Ritter, representing the New York Chapter's committee, stated that while the entire subscriptions from all over the country totalled $9,450, those from the New York district amounted so far to only $1675. He thought this showing was one that did not begin to represent what New York could and would do and he urged the members to use theiy efforts in keeping the ball rolling towards the desired goal.

President Walter S. Timmis of the society, stated that both the American Gas Association and the Boiler and Radiator Manufacturers' Association were considering the matter of making generous subscriptions towards the work and he expected shortly to be able to make interesting announcements in this connection.

J. I. Lyle, chairman of the Research Committee, stated that not only were the facilities of the Bureau of Mines building in Pittsburgh to be placed at the disposal of the research bureau, but that now that the war activities were over, the Bureau of Standards was prepared to take up some features of the work being planned by the Research Committee. He stated that $10,000 per year for a period of five years would not begin to be enough to adequately carry out the plans and that every effort should be made to increase this amount. He expressed the hope that the campaign would not be allowed to lag now that the goal was in sight.

Illinois Chapter

Over 70 members and guests of the Illinois Chapter attended the February meeting, which was held February 10, at the Chicago Engineers' Club. The principal speaker was Lieutenant E. W. Wagenseil who told of the great United States Aviation Camp at Queenstown, Ireland, illustrated by nearly 500 photographs of scenes in Ireland, England and France which proved of the greatest interest to those present. Previous to his address, E. J. Claffey gave an account of the meeting of the society in New York in January. President G. W. Hubbard presided.

Eastern Pennsylvania Chapter Discusses the Weather.

It was not for want of some better topic that the Eastern Pennsylvania Chapter discussed the weather at its February meeting, which was held February 13, at the Engineers' Club. The chapter has been interested for some time in furthering the movement for better methods on the part of the weather bureaus in recording weather conditions. The principal speaker was George F. Bliss.

Bill in New York Legislature to Enforce Heating of Apartments.

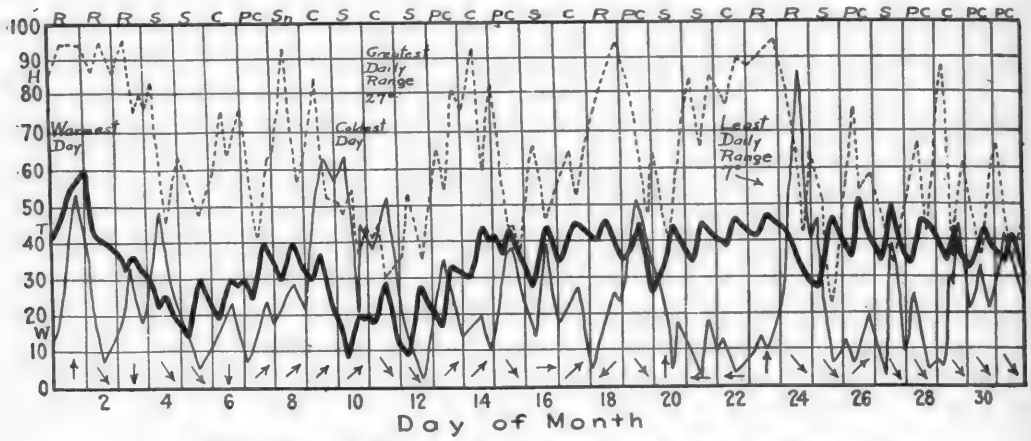
A proposed bill introduced in the New York Assembly provides that:

"An owner, lessee or agent of any dwelling and tenement property, or portions thereof in the City of New York which is rented or leased to a tenant or tenants, with artifical heat from month to month or for a term of years or for any other term, and where minors under the age of sixteen years reside, who, having expressly or impliedly agreed to furnish heat and who during the months of October, November, December, January, February and March of every year, whenever the temperature makes such heat necessary, shall negligently and wilfully fail to furnish heat at an even temperature of at least 68° F. from six o'clock in the morning to ten o'clock at night, is guilty of a misdemeanor punishable by fine of two hundred dollars, or imprisonment of ten days, or both."

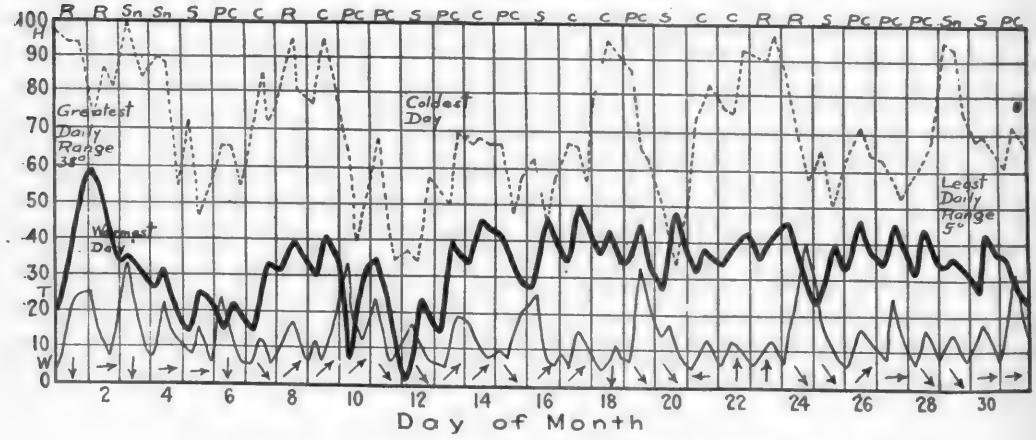
A similar bill, also introduced in the Assembly, denies the owner, lessee or agent of such property the benefit of summary proceedings against the tenant. The tenant shall be entitled in such a proceeding to set up as a complete defense such failure to furnish heat. Where the tenant establishes such defense, the court may not grant the landlord a judgment unless the landlord establishes that such failure to furnish heat was not wilful or negligent. Where the court finds that the failure to furnish heat was wilful or negligent a judgment may be granted for the landlord only upon a stay of execution of not less than forty nor more than sixty days. The tenant may in addition plead, prove and recover by way of defense or counter-claim actual damages suffered by reason of failure to furnish heat.

THE WEATHER FOR JANUARY, 1919

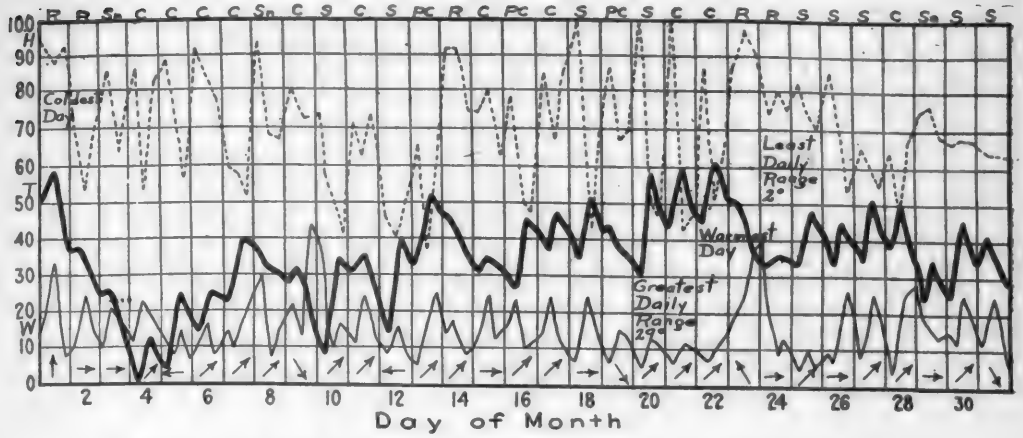
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	60	59	61	52	62
Date of highest temperature	1	2	22	20	20
Lowest temperature, degrees F.	9	2	1	— 11	— 3
Date of lowest temperature	10	12	4	4	3
Greatest daily range, degrees F.	27	38	29	26	31
Date of greatest daily range	11	1	20	1	10
Least daily range, degrees F.	7	5	2	4	6
Date of least daily range	23	29	24	23	5
Mean. temp. for month, degrees F.	35.2	33	34	31	37.8
Normal mean. temp. for month, degrees F.	30.2	27	30.7	23.7	31
Total rainfall, inches	3.35	3.62	1.42	0.2	0.13
Total snowfall, inches	0.3	4.1	3.7	1.8	0.7
Normal precipitation, this month, inches	3.79	3.82	2.87	2.0	2.27
Total wind movement, miles	13912	7984	8882	10352	9400
Average hourly wind velocity, miles	18.7	10.7	11.9	13.9	12.6
Prevailing direction of wind	N. W.	W.	S. W.	W.	N. W.
Number of clear days	9	6	9	11	19
Number of partly cloudy days	8	11	4	10	10
Number of cloudy days	14	14	18	10	2
Number of days on which rain fell	11	8	8	2	5
Number of days on which snow fell	1	2	2	2	1
Snow on ground at end of month	None	Trace	None	None	None



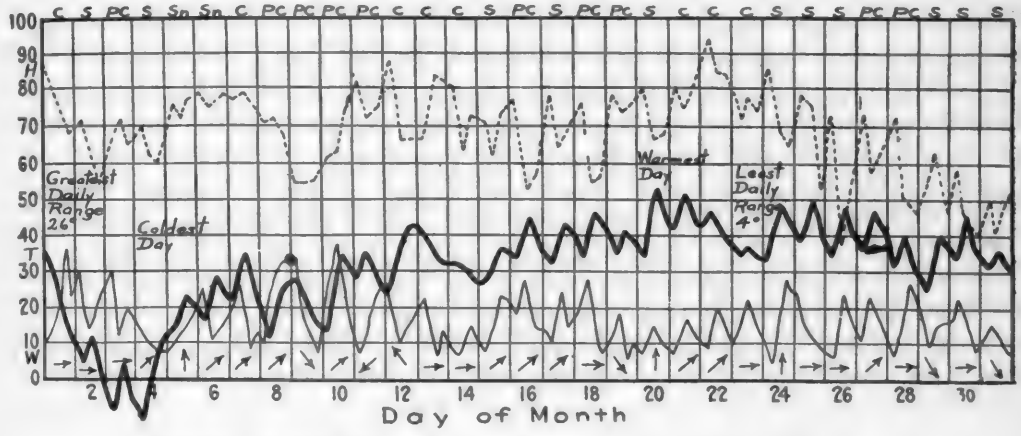
RECORD OF THE WEATHER IN NEW YORK FOR JANUARY, 1919.
(Relative Humidity Curve Plotted From Hourly Readings.)



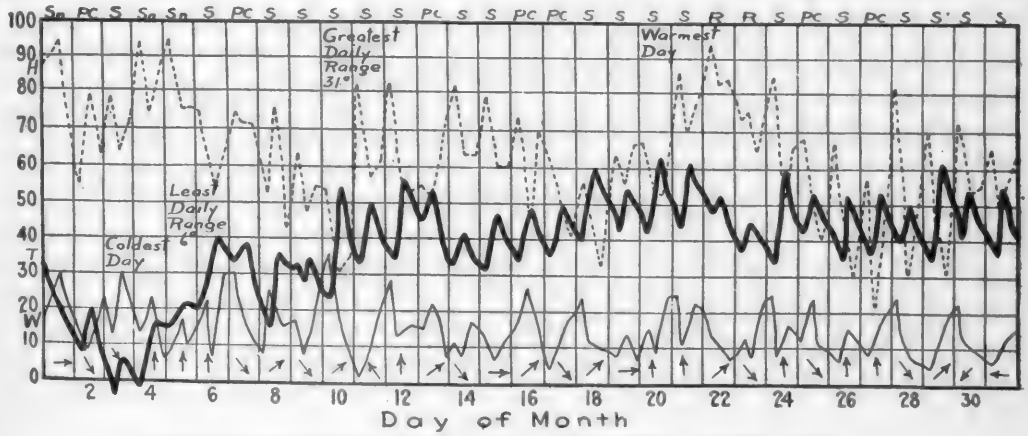
RECORD OF THE WEATHER IN BOSTON FOR JANUARY, 1919.



RECORD OF THE WEATHER IN PITTSBURGH FOR JANUARY, 1919.



RECORD OF THE WEATHER IN CHICAGO FOR JANUARY, 1919.



RECORD OF THE WEATHER IN ST. LOUIS FOR JANUARY, 1919.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicates temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in per centage from readings taken at 8 A. M., 12 M., and 8 P. M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

Use of Motion Pictures to Educate the Public in Heating and Ventilation.

Few people are aware of the rapid development of the industrial motion picture during the past two years which has already made it adaptable to almost every line of business, including that of heating and ventilation. The use of this form of publicity is now being proposed as an answer to the question of how to educate the public in good practice along these lines.

The development has reached a point where a suitcase projector, easily carried in the hand, is being furnished so that it is a comparatively easy matter to carry the campaign home to the public through the display of buildings equipped with adequate heating and ventilating systems. It is suggested that such films could be displayed before local organizations and even neighborhood clubs.

Among the suggestions offered is that such a film should take up the romance of the heater and ventilator, proceeding from that point to the portrayal of heating and ventilating processes, from the manufacturing operations to the use of the finished system, with, perhaps, some good examples of improper use and the consequences.

What One Large Company Did to Help Win the War.

General Guy E. Tripp, who during the war was assistant to the Chief of Ordnance in Washington, and who has now returned to his duties in New York as chairman of the board of the Westinghouse Electric & Mfg. Company, speaks enthusiastically of the aid received by the government from the men and women making up the great commercial organizations. In the case of the Westinghouse employees he stated that nearly 40,000 were comprised in the industrial army that devoted their efforts to producing war material. The company's plants operated day and night.

As evidence of the contribution of manpower to the fighting forces on land and sea, the company's service flag has 7,468 stars, with a large proportion of commissioned officers of various grades.

General Tripp stated that 500 cars of shells a month were shipped from the Westinghouse plants in the Pittsburgh district alone, averaging nearly 20 carloads per day. Since the beginning of the European War, the Westinghouse plants have furnished 6,000,000 shells, and since the United States entered the war, have furnished to the United States and to Great Britain nearly 3,000,000 shells, 8,500,000 rifle grenades and 500,000 grenade dischargers.

So imperative became the demands for marine propelling equipments from the Emergency Fleet Corporation that the new Essington plant was built at South Philadelphia where over 350 complete marine propulsion equipments were completed or under construction at the time the armistice was signed.

Finally, the New England Westinghouse Company made a record by turning out a total of 1,000,000 rifles within a calendar year, and produced during the last week of the year an average of 7,000 rifles per day. The company also turned out Browning Machine guns at the rate of about 3,000 per month, the total deliveries being 20% greater than the number of machine guns surrendered by the Germans.

Practical Hints on Steam Saving.

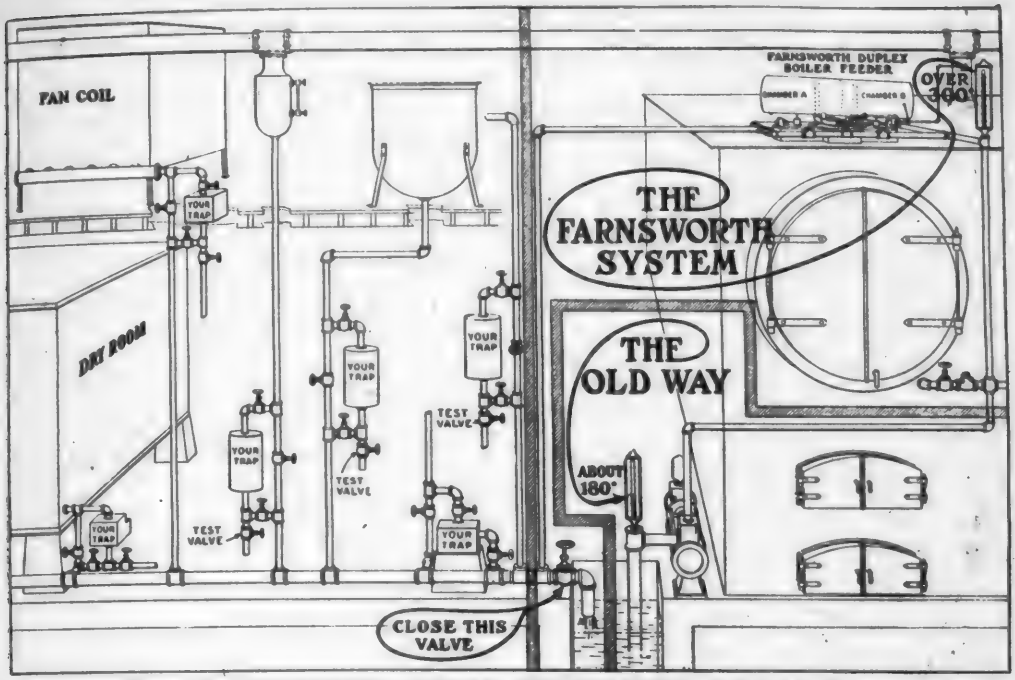
The problem of saving is discussed in an interesting manner in the following statement by F. C. Farnsworth, president of the Farnsworth Co., Conshohocken, Pa., manufacturer of steam utilities.

"All plants," he said, "waste coal if they do not drain their condensation from all of their high-pressure traps and feed it directly into the boilers under pressure at a high temperature which conserves the heat units in the condensate.

"For an illustration, if you were to install a thermometer inside a common steam trap of any type, you would find that the temperature of the condensate before it leaves the trap is at a temperature nearly that of the steam on the system that the trap is draining.

"Therefore you will note the difference in the thermometers above. The old way of discharging the condensation from the high pressure trap into a hot well, receiving tank, or a low-pressure feed-water heater, allows the high temperature condensation to cool down equal to the temperature of the hot well, receiving tank or low-pressure heater.

"If in a hot well, with the pump above the hot well, it is practically impossible to pump the water into the boiler at a temperature much over 180°, while if it is discharged into a receiving tank, it is then possible to pump the water into the boiler at about 200°, or if it were discharged into a low-pressure heater, carrying a few pounds back pressure from the engine, then it is possible to heat the water up to about 212°. But when the water becomes at a temperature about 212°



ARRANGEMENT OF FARNSWORTH SYSTEM FOR DRAINING HIGH-PRESSURE TRAPS TO BOILER AT A HIGH TEMPERATURE.

the average pump will give a certain amount of trouble, due to handling the high temperature water.

"It will be noted from the accompanying sketch that the water going into the hot well is shut off and carried to a Farnsworth duplex boiler-feeder which has two chambers. One chamber is always receiving the condensate and the opposite chamber always under pressure delivering the water into the boiler.

"The alternate filling and emptying of these chambers provides a continuous flow of condensate directly from the high-pressure traps, directly into the boiler under pressure and at a high temperature.

"The two thermometers in the sketch show that there is a 120 heat unit loss in every pound of water that is fed into the boilers. For an illustration, if 500 horse power were used for a 24-hour day, 396,000 lbs. of water would have to be pumped into the boiler with a total loss of 47,520,000 B. T. U.

"In addition to this, the Farnsworth boiler-feeder uses about 90% less steam than a common piston or centrifugal type pump."

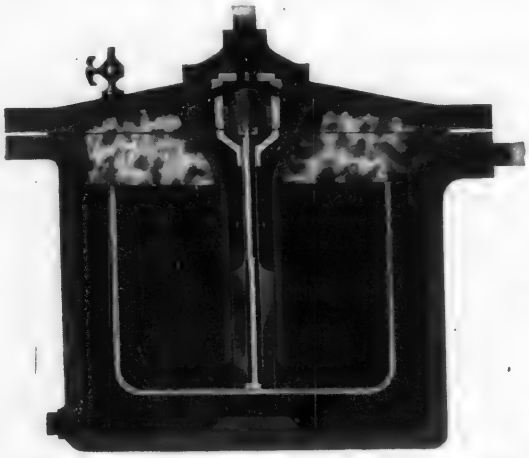
Trade Literature.

BARBER PATENTED GAS BURNER, adaptable to domestic heating furnaces and requiring no mechanical air-mixing device, is described in circular matter published by the Cleveland Gas Burner & Appliance Co., Cleveland, O. The burner is guaranteed to burn at atmospheric pressure and, it is stated, will not deposit carbon at a pressure above one-fourth of an ounce. In the construction of the burner the air is made to flow by natural confluence, creating a vacuum. This acts to draw only the natural and necessary amount of air required, and also automatically accomplishes the desired mixture. It can be removed from any furnace in a few moments, if the gas supply should be shut off. The burner is constructed in unit form, each unit being controlled by a separate valve so that one or more units can be used, as desired. No pilot light is required; when one unit is lighted, any of the others will ignite upon turning on the valves controlling them. Barber burners are generally installed through the feed door and it is not necessary to make any change in the furnace. Directions are included for installing these burners which are made in a variety of styles and sizes.

BOILER LOGIC, an 86-page treatise on steam boilers, featuring the product of the Heine Safety Boiler Co., St. Louis, Mo., is a new publication recently issued by this company. Among the subjects covered are fundamental considerations of boiler design, including furnace design requirements, such as mixing time and temperature; heat transmission from fire by radiation, by convection, through tube and to water. This is followed by a discussion of practical baffling of water-tube boilers. Heine boilers

for different fuels, firing and services are then taken up, the treatise concluding with a discussion of overloads, the boiler as a pressure vessel and details of construction of the Heine boiler. Numerous technical illustrations accompany the text, as well as views of various types of Heine boilers. Size 6 x 9 in. (standard).

VANCE STEAM TRAPS, made for both high and low-pressure work, are featured in circular matter published by the Vance-Vetter Co., Pittsburgh, Pa. Both types are of unusually compact construction and their principle of operation goes far to-



VANCE STEAM TRAP, LOW PRESSURE STYLE.

wards insuring satisfactory action in use. The high-pressure type is built with a double valve, including a main valve and a pilot valve. The low-pressure type is almost identical in construction, except that it is made with a single valve. The condensation enters the trap at the inlet near the top, impinging on a baffle plate and overflowing into the bucket. When the bucket is full it drops and opens the valve leading to the outlet through the center of the cover. The condensation is then discharged from the bucket down to the low-water line which keep the end of the discharge tube always water-sealed. The bucket then rises and the valve closes. Vance traps, it will be noticed, are intermittent. This is considered an advantage by the manufacturers on the ground that it reduces wear on the valve and seat. The circular shows the proper arangement for this type of trap and includes list prices for four high-pressure sizes and three low-pressure sizes, the low-pressure sizes being designed to operate on 1 to 5, 5 to 10 and 10 to 20 lbs. working pressure respectively. There is also added an impressive list of users of Vance traps.

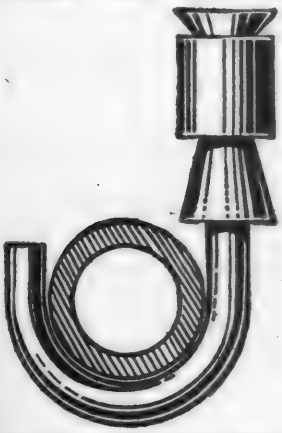
OUTDOOR SERVICE FOOT WARMER is an interesting device described in circular matter issued by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The electric foot warmer has been developed to meet the need of those compelled to be in the open and who may be exposed to cold feet, with particular reference to watchmen, traffic policemen, etc. This heater is waterproof, and is equipped with a three-heat control. It is made either of cast-iron or copper, in one piece, and is usually made 14 in. wide, 20 in. long and 2½ in. high. The cable of rubber-insulated triple conductor enters the foot warmer through a bellmouth waterproof fitting mounted in the middle of one 14-in. side.

APPEL'S SYSTEM OF ELECTRIC HEATING is brought to the attention of the trade in a circular containing general information and answers to usual questions, published by the Electric Sales Corporation, Henry Building, Seattle, Wash. This system makes use of electrically-heated radiators, each radiator being a separate and distinct heating unit. In appearance it is similar to a hot-water radiator of the ordinary type and is filled with a non-corroding, non-freezing liquid which does not require renewing. It is stated that an improved type of heating element is contained in the bottom longitudinal passage of the radiator, the liquid circulating through the vertical, upper and lower longitudinal passages. The manufactures state that the particular

APPEL ELECTRIC RADIATOR.

reason for the increased efficiency of the Apfel electric radiator over radiators of the hot-wire type, may be illustrated by placing a pie tin over a gas flame. In other words, it is claimed, there is a material increase of the radiating surface exposed to the atmosphere to be heated, and consequently a greater heating effect. All of the electric appliances, it is pointed out, are contained inside the radiator, so that there is no danger of burning or injury by the electricity or heat produced. This radiator was designed by P. F. Apfel, whose experience in steam and hot-water engineering work covers a period of about fourteen years. The company also makes an electric glue heater and an electric chocolate-dripping table, using the same principles of a wide area of heat distribution.

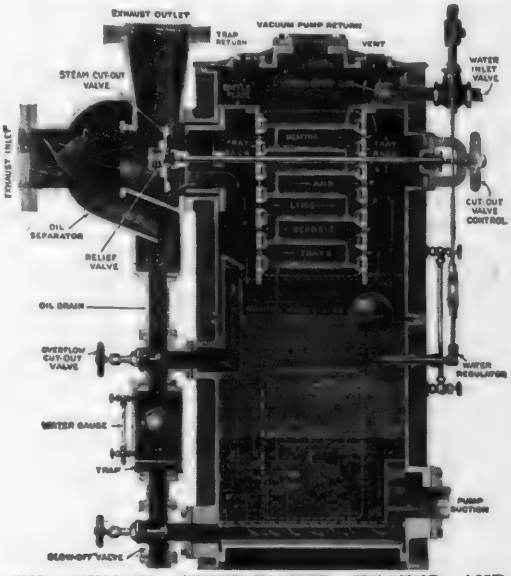
CHICAGO METHOD OF FASTENING TO MASONRY is the title of a circular issued by the Chicago Expansion Bolt Co., whose address is now 324 West Washington Street., Chicago. The circular is devoted to this company line of expansion bolts. The bolt consists of four parts, the galvanized bolt, a soft lead cylinder, a hard metal cone and a nut. The conduit hanger has a U-shaped body which clamps the



CHICAGO CONDUIT HANGER.

pipe, one side being provided with an expansion feature which secures it to the wall or ceiling. The manufacturers state that it costs no more than an ordinary expansion bolt. As no other fixture, with separate bolts and nuts, is required, it permits a considerable saving both in labor and material. It is made in sizes adapted to all sizes of conduits and may be had either galvanized, black or plain finish. The directions for using are to first drill a hole and, second, to put the conduit in place and drive the hanger in with a fluted punch. It leaves no protruding ends of hanger bolts or nuts. The hanger is made in various sizes to fit all standard sizes of conduits.

SWARTWOUT ALL-SERVICE FEED-WATER HEATER AND RECEIVER, designed by T. J. Cookson, M. E., and made by the Ohio Blower Co., Cleveland, O., is the subject of a well-prepared circular giving a clear explanation of the design and functions of this interesting appliance. It is designed for all kinds of service to which an open or direct-type heater may be subjected. It is also of unit construction so that immediate and economical expansion of the heater already in use may be provided. One of the patented



SWARTWOUT FEEED-WATER HEATER AND RECEIVER.

features of this heater is the arrangement for separating the oil and condensate. The steam enters through a patented helix which imparts a whirling motion to the steam. The oil and condensate are whirled against the walls of the separator chambers where they collect and run down to the trap and thence to the waste pipe. After the steam is purified it enters the body of the heater.

As this steam is in a purified state, all above the amount necessary to heat the water, or about 84%, passes out the steam stack and may be used for heating or drying purposes. The steam opening into the heating chamber is provided with a cut-out valve of the floating valve type. The overflow is also provided with a cut-out valve, so that the operator may cut the heater out of service at any time without stopping the engine. There is also an automatic relief valve on the main steam cut-out valve.

Convention and Dinner of Carrier Engineering Corporation.

Following a two-day convention of its 70 odd executives, engineers and sales force, the staff of the Carrier Engineering Corporation, of New York, wound up an eventful week with a dinner at the Hotel McAlpin, January 31, that will long be remembered by those present.

While the remarkable success of this lusty corporation was, perhaps, foremost in the minds of the diners, the most impressive feature of the gathering was the spirit of good fellowship displayed by the entire personnel of the company.

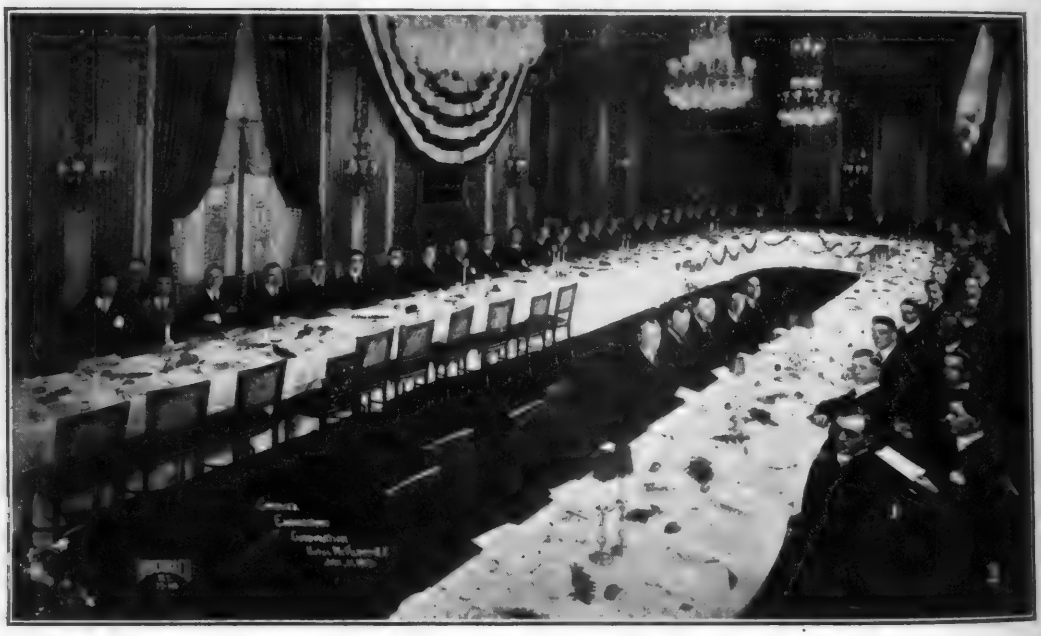
The dinner itself was run along military lines, under Charles J. Staples, of Buffalo, officer of the day. Breaches of discipline, it must be said, were frequent, and necessitated frequent calls upon the corporal of the guard, whose penalties ran all the way from ignominious expulsion from the hall to compulsory singing on the part of the culprits.

W. H. Carrier welcomed the diners. L. L. Lewis spoke of "Optimism" and E. T. Murphy was down for "A Knock," but the presentation of a traveling bag and portfolio on the part of his associates just before his turn came to speak, sent his prepared remarks to the scrapheap. President H. W. Wendt, of the Buffalo Forge Company, was ordered around by the officer of the day, who boasted that he was taking full advantage of his unusual opportunity. Mr. Wendt took his medicine like a true soldier and then proceeded to give some sound advice to those connected with the corporation, emphasizing the attributes of loyalty and patience. H. K. Brent told of the way the bond was handled in connection with the corporation's $500,000 government contract, and congratulated the company on the fact that the determining factor in securing the bond was the reputation of the company's president, Mr. Carrier, and its general manager, J. I. Lyle.

President Walter S. Timmis made his first appearance following his election as president of the American Society of Heating and Ventilating Engineers and gave an interesting account of "Carrier's start," which was, in many respects, a history of air conditioning, as now practised.

General Manager J. I. Lyle said the corporation was prepared to take back all of its force who had joined the colors and announced that of the 100 names that had been registered on the company's regular payroll, no less than 70 names are still there and he hoped this condition would long continue.

Before the speechmaking began the diners were entertained by "Billy" Murray with songs and by Monroe Silver, the magician. "Jack" Armour was also on hand with his kit of stories.



DINNER OF THE CARRIER ENGINEERING CORPORATION'S STAFF AT THE HOTEL MC ALPIN, JANUARY 31, 1919.

Death of William M. Mackay.

William M. Mackay, one of the pioneers of the heating industry in this country, a charter member of the American Society of Heating and Ventilating engineers, its president in 1897 and for eleven years, from 1899 to 1911, secretary of that society, died February 19 at St. Mary's Memorial Hospital, in Orange, N. J., of pneumonia. He had previously been ill with influenza.

Mr. Mackay was 63 years old. He was a specialist in boiler construction and some of the types on the market today, including the Mackay boiler, were built according to his design. He was also a specialist in hot water heating.

At the time of the formation of the American Boiler Company, he was made manager of the heating and ventilation division for school house work. He later represented the Hart & Crouse Company for many years as New York manager and had also conducted a consulting engineering business. At the time of his death he was president of the Mackay Mfg. Company which was about to manufacture the Mackay down-draft boiler.

Mr. Mackay is the third former president of the American Society of Heating and Ventilating Engineers to die during the past six months, the other two being Professor William Kent and Professor Rolla C. Carpenter. He was one of the original stockholders of the Heating and Ventilating Magazine Company.

LIEUTENANT L. MASON BRUCH, oldest son of Louis Bruch, vice-president of the American Radiator Co., Chicago, lost his life on the fighting front of France, November 10. He was killed in action at Inor-sur-Meuse and was buried by the Germans on the bank of that river. Lieutenant Bruch was 26 years old and was a graduate of the Law School of the University of Michigan. He was in the U. S. Aero Service and went to France in September, 1917 as a member of the 91st Aero Squadron. He had been at the front only a few days when he was shot down.

JAMES J. WADE, an old-time figure in the Chicago plumbing field, died at his home in that city, January 26, of heart disease. He was 76 years old. Mr. Wade was prominently identified with association work and did much to elevate the plumbing trade. He was a familiar figure at conventions of the National Association of Master Plumbers and was at one time secretary of that association. He had also served as president of the Chicago Master Plumbers' Association.

Merchants' Association of New York Opposes Government Ownership of Public Utilities.

In a report covering the broad subject of government ownership, the Merchants' Association of New York, has come out flat-footedly against such government ownership of public utilities and backs its position in a lengthy and thoughtful argument covering all the principal phases of the subject. Some of the principal points brought out are that government ownership would exclude private enterprise, that political selection produces a personnel poorly qualified for economic service, that zeal and energy would be deadened, that financial needs of a public business undertaking are usually not promptly or sufficiently met, that there would be wasteful distribution of capital outlays, and that present defects under private ownership are curable.

SETS OF STANDARD DATA SHEETS AT SPECIAL PRICES.

Standard heating and data sheets, which are published each month in The Heating and Ventilating Magazine, are now complete for such subjects as "Tables of Heat Transmission Factors," "Methods of Computing Heat Losses," "Air Changes," "Ducts and Flues (including seven different methods of sizing)," "Chimneys and Fittings."

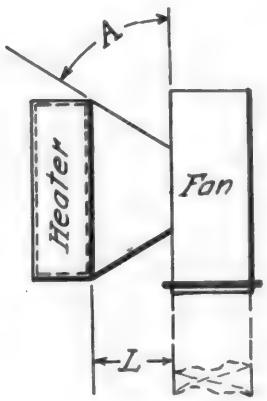
For the benefit of those desiring extra sheets, printed on one side only, covering any particular topic, we are able to make the following offer.

Set No. 1—B. T. U. Losses 8 sheets	**25 cents.**
Set No. 2—Computing heat losses, 6 sheets	**20 cents.**
Set No. 3—Air Changes, 5 sheets	**15 cents.**
Set No. 4—Ducts and Flues (including seven methods of sizing) 24 sheets	**$1.00**
Set No. 5—Chimneys, 13 sheets	**50 cents.**
Set No. 6—Fittings, 13 sheets	**50 cents.**

Any of these sets will be mailed postpaid, on receipt of price. Order by number of set. Copies of other data sheets, printed separately on one side only, 5 cents each, postpaid.
Address,

Heating and Ventilating Magazine Co.,
1123 Broadway, New York.

DISTANCE BETWEEN FAN AND HEATER.



In a draw-through arrangement the minimum allowable distance between the fan inlet and the end of the heater is a most important item. If this distance is made too short and the transformation from the shape and size of the heater outlet down to the shape and size of the fan inlet becomes too abrupt, serious results may follow. Of course the sharp transformation tends to produce eddy currents and thus increase the friction against which the fan must operate, but this is not the most objectionable feature resulting.

When a connection of this kind is too short the air tends to follow a straight line which may be drawn from the side of the heater inlet to the circumference of the fan inlet and will thus short-circuit a large part of the heater near the outlet all around the outside of the heater.

The United States Government recommends that the angle A, as shown in the illustration should be not less than 60° in order to avoid this difficulty, while the Buffalo Forge Company gives the following schedule:

Size of Fan. Inches.	Length L. Inches.
Up to 70	18 to 24
70 to 100	24 to 30
100 to 130	36
130 to 170	42
170 to 200	48 to 54

CAPACITY OF STEAM MAINS IN SQUARE FEET OF EQUIVALENT DIRECT RADIATION.

For a Total Pressure Drop of 1/4 Lb.

Size of Pipe, In Diam.	Length of Run. Feet.											
	100	200	300	400	500	750	1000	1250	1500	2000	3000	3500
	Square Feet of Equivalent Direct Radiation.											
¾	40	29	23	20								
1	90	66	52	46	40	31	29	26	43	38	29	22
1¼	167	118	97	84	75	61	53	47	72	62	54	51
1½	277	195	154	133	123	101	87	79	175	150	133	124
2	609	450	375	325	295	250	210	185	275	245	211	195
2½	1060	725	600	525	480	400	340	300	500	430	383	353
3	1925	1350	1100	940	850	700	625	600	725	625	555	512
3½	2750	1950	1575	1360	1250	1000	900	800	1025	875	775	725
4	3850	2725	2225	1910	1725	1400	1250	1100	1375	1175	1025	975
4½	5160	3625	2960	2550	2300	1875	1650	1500	1825	1600	1375	1280
5	6840	4850	3975	3410	3090	2500	2225	2000	2900	2540	2225	2025
6	11000	7775	6400	5475	4850	4025	3600	3200	4175	3660	3200	2975
7	16000	11500	9325	7960	7100	5800	5100	4700	6000	5100	4575	4400
8	22500	16000	13000	11200	10000	8100	6800	6300	7800	6850	6050	5500
9	30000	22000	17000	15000	19500	11000	9400	8400	10500	9120	8071	7358
10	40000	29000	23300	20000	18000	14600	12700	11500	16800	16200	12800	11500
12	63000	45000	36750	31810	28400	23000	19700	18100	21400	18600	16500	15000
14	85000	60000	47400	41000	36500	29500	25800	23500	25500	22000	19700	17800
15	100000	70400	57000	49100	43500	35500	30500	27700	31000	27000	24300	22000
16	119000	85000	70000	60500	54000	43600	37900	34200	42000	36300	32200	29600
18	160000	114000	93000	80000	72000	59000	51000	45500	52000	45300	40250	36600
20	200000	142000	115000	100000	90000	73000	63000	57700				

ONE-PIPE GRAVITY STEAM SYSTEMS.

General.

The one-pipe system may be installed in several different ways and involves the use of only one control valve and one pipe connection to each radiator; automatic air valves are used for relieving air the same as on the ordinary two-pipe system. As far as labor is concerned, the increase of one pipe size in the steam supply does not produce an appreciable difference in work of installation and the added cost of the pipe is small; in exchange for this, all return valves, return risers and (to a greater or less extent) all return mains in the basement can be omitted, resulting in a considerable economy over the cost of a two-pipe job.

While not the most satisfactory method in operation, the true and complete one-pipe system throughout involves the use of a single steam main of enlarged size to accommodate the condensation in the bottom of the main, instead of a separate return pipe; the idea also assumes that the condensation will flow in a direction opposite to the flow of the steam which is, of course, not ideal. As a general rule, the smaller the quantity of water so flowing, the less will be the trouble resulting therefrom.

With the true one-pipe system throughout, the steam main, risers and branches all pitch back to a point near the boiler where the condensation is allowed to separate itself and to drop down under the water line, returning to the boiler through the regular return connection. Such a system is seldom used, except for small residences, owing to the large quantities of condensation bucking against the flow of steam in the mains, and the slight modifications necessary to eliminate this difficulty are almost invariably adopted for any work of importance.

ONE-PIPE GRAVITY STEAM SYSTEMS.

Circuit Main System.

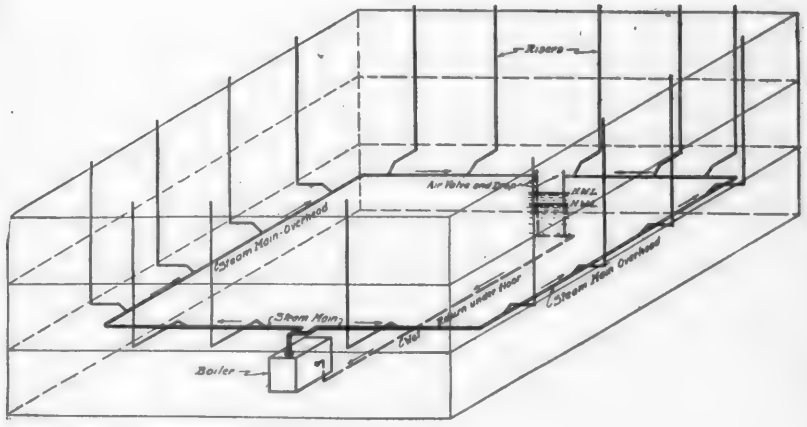


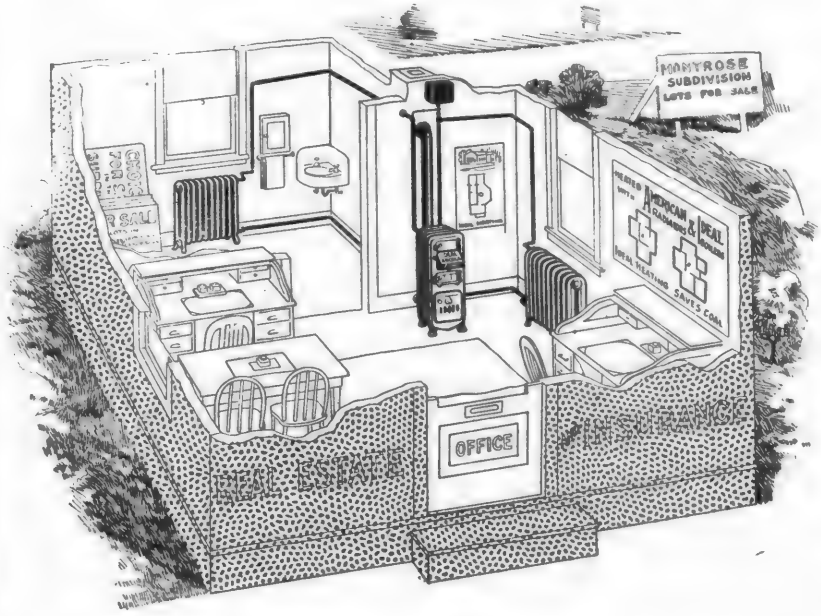
FIG. 1.

To obviate the difficulty experienced with the true one-pipe system, what is known as the "circuit main" system has been used with great success. In this scheme, as shown in Fig. 1, the radiator runouts, risers and branches are left pitching down from the radiators and against the steam flow, but the steam main—the point of greatest trouble—is pitched with the flow of the steam so that the condensation flows along with the steam, instead of against it. At the end of the steam main run a drip pipe, or "bleeder," as it is commonly called, is dropped down below the water-line and carried back as a wet return. The pipes are pitched down in the direction indicated by the arrows and all pockets should be avoided by the use of eccentric fittings or flanges, while expansion must be properly cared for, both on the steam and return main and in the radiator connections to the risers.

It will be noted that, with the exception of the runouts and riser branches, all of the condensation flows with the steam and as long as the risers do not get too big, *i. e.*, have too much radiation placed on them so as to produce an excessive quantity of condensation flowing back down—there is no difficulty experienced with this piping arrangement.

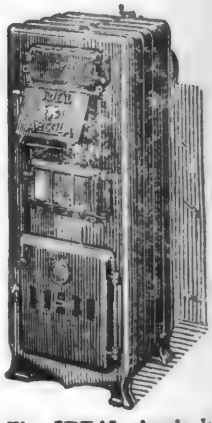
IDEAL Arcola Hot Water Heating Boiler

For cellarless small houses and flats



This illustrates the simplicity of installation of an IDEAL Arcola Boiler and two AMERICAN Radiators in a cellarless small office building. The piping is, of course, ordinarily run out of sight, within walls or partitions.

The architect has in the IDEAL Arcola a most satisfactory solution of the individual heating demands of his factory and community housing plans. In general purpose like a stove, heating the room in which it is placed, but unlike a stove, providing circulating hot water for radiators in adjoining rooms. Great fuel saving, together with the desirable and equitable warmth of Hot Water Heating, is secured.



The IDEAL Arcola is both a Boiler and a Radiator

Write today for special literature illustrating and describing the IDEAL Arcola

AMERICAN RADIATOR COMPANY

Sales branches and showrooms in all the large cities

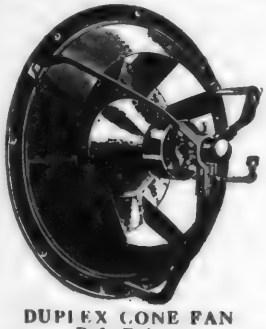
TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

National Foreign Trade Council will hold its sixth national foreign trade convention in Chicago, April 24-26, 1919. Headquarters will be at the Congress Hotel. "Foreign Trade Essential to American Industry" will be the theme of the convention. All Americans engaged in or desirous of entering overseas commerce, and especially all chambers of commerce, boards of trade, trade associations, and other commercial and industrial organizations, as well as firms and individuals, are invited to take part in the convention. Among the sub-topics will be America's need of foreign trade, commercial education for foreign trade, foreign trade merchandising, the American merchant marine and foreign credits. The secretary of the council is O. K. Davis, 1 Hanover Square, New York.

Associated Advertising Clubs of the World have moved their headquarters from Indianapolis to New York, with offices at 110 West 40th Street.

Kansas City, Mo.—A proposal to adopt on ordinance in Kansas City compelling landlords to maintain a minimum temperature in apartment houses of 70° F. during the winter months, except between the hours of 10 p. m. and 5 a. m., and 60° F. during that interval with fines ranging from $1.00 to $500 aroused such opposition that the measure was killed, although it was stated a substitute proposal would be made. The proposal was made originally on account of the influenza epidemic when complaints were made of insufficient heating. The Real Estate Board opposed the plan on the ground that it would leave an opening for rent dodgers and that such restrictions would discourage capital from



DUPLEX CONE FAN
Belt Driven

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Ventilating Engineers and Contractors
MANUFACTURERS OF
BLACKMAN and DUPLEX CONE FANS
which are installed by us complete with **Motors, Duct Work** and **Wiring**.

Aligning, Rigging and **Hoisting** done, with labor thoroughly qualified from long experience.

We make a specialty of **Kitchen Exhaust** work. Prominent buildings, hospitals, theatres, and private residences are among our many and recent installations.

The **Duplex Cone** Fans are semi-conoidal fans, made especially to operate against pressure in duct systems.

The **Blackman** Fans are used for fresh air delivery and in duct systems, when no great pressure is involved.

You can have the advantage of our experience.

SEND FOR CATALOGUE

BLACKMAN FAN
Direct Connected to Motor

building apartment houses. The point was made that it would be impossible at times to maintain the fixed temperatures specified and that in any event it would mean the employment of two janitors in most establishments.

National Association of Brass Manufacturers held a special meeting in Chicago February 19-21 at he Congress Hotel, to discuss principally the unusual conditions arising in connection with the work of reconstruction.

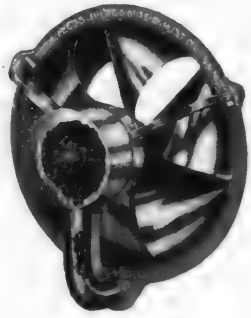
Heating and Piping Contractors' Association, Inc., held a social meeting at Young's Hotel, Boston, January 29, with President Frank A. Merrill as master of ceremonies. The affair was in the nature of a get-together meeting to prepare the trade for the return to normal business conditions.

A. A. Gray & Co., Chicago, Ill., have opened an office in the Marquette Building, "to assist manufacturers in solving their problems of production, advertising, and selling distribution." Major Ainslie A. Gray, head of the firm, has recently been discharged from government service, having been connected with the Ordnance Department. The organization will handle accounts in trade, technical and national mediums.

Wisconsin Master Steam and Hot Water

ILG FANS and BLOWERS

are extensively used by leading industries everywhere for heating and ventilating in their various phases



Sizes 12″ to 72″
Various Currents

ILG "Self Cooled Motor" propeller fans operate most economically and with greater effect in extreme conditions with constant service. A stream of air through the patented "vent pipe" and enclosure keeps the motor cool and free from injurious effects of moistures, fumes, dust, etc.

Direct Connected or Belt Driven

ILG Universal Blowers are compact and interchangeable. Easiest to install in cramped spaces. Reliable efficiency—low power consumption—quiet running.

Pocket Manuals illustrating propeller fans, pressure and volume blowers, on request

ILG ELECTRIC VENTILATING CO.

158 Whiting St., Chicago, Ill.

Branches in all large cities

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

DETROIT PACKLESS RADIATOR VALVES

The Correct Radiator Valve for Vapor Heating

The Detroit Packless Vacu Valve is a Graduated Valve for Vapor and Vacuum Systems of Heating. The dial plate is provided with a series of holes and a movable pin. This pin acts as a stop for the handle pointer and is inserted in the hole in the dial nearest the point at which the valve, when opened, admits only sufficient vapor or steam to fully supply the radiator.

DETROIT PACKLESS
Vacu Valve showing Dial Plate and Lever Handle

Booklet VP-1 Gladly Sent Upon Request

DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.

LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

Fitters held it annual convention in Milwaukee, January 13, when the association changed its name to Heating and Piping Contractors' Wisconsin Association, to conform with the title of the National association. The new officers of the association are: President, Frank H. Meadows, Milwaukee; vice-president, James Sullivan, Stevens Point, secretary and treasurer, Fred Kaufman, Milwaukee; recording secretary, Joseph H. Volk, Milwaukee. Board of directors: Edmund Grassler, Milwaukee; Fred Kaufman, Milwaukee; F. H. Meadows, Milwaukee; J. B. Sullivan, Stevens Point; E. J. Sullivan, Kenosha; F. E. Grebbe, Waupun; Wm. J. Bresnahan, Fond du Lac, and Frank Muller, Milwaukee.

Manufacturers' Notes

Hoffman Specialty Co., Chicago, Ill., announces with regret that A. S. Lindebald

PIPE BENDING

MARINE EQUIPMENT AND REPAIR WORK
HEATING AND VENTILATING

THE OHIO HEATING AND PIPE BENDING CO.

Main Office and Factory, 1061-63 West 11th Street, Cleveland, Ohio

SOLE AGENTS FOR

F. J. Nice Oil and Combination Oil and Gas Burners

RIC-WIL METHOD

MAKES GOOD
Heating Systems Better

The Ric-wiL METHOD of insulating underground steam and hot water pipes is a complete system which will save from 80% to 90% of the loss from the pipes if bare. The materials consist of a special tile conduit—vitrified and salt glazed—lined with a mineral insulation; a tile Base Drain to support the conduit and carry away the ground water, roller bearings for carrying the pipes and loose insulation for packing around them.

Write for our 40-page catalogue which explains these materials more fully

THE Ric-wiL COMPANY, CLEVELAND

BOUND VOLUMES OF

The Heating and Ventilating Magazine

Vol. XV for 1918 Now Ready

Suitably Bound in Cloth and Containing Full Cross Index

Price, postpaid, $3.50

HEATING AND VENTILATING MAGAZINE, 1123 Broadway, New York

who, it is stated, "has so ably represented us in the sale of Hoffman valves," has tendered his resignation taking effect February 1. The company also announces that William G. Boales has been appointed as Mr. Lindebald's successor. Mr. Boales is a practical steam heating engineer. He was manager for several years of the heating department of Crane Co., in St. Louis. He has been with the Hoffman company since 1916 taking care at first of the company's interests in the west and south. He was transferred to New York early in 1917 where he successfully represented the company in the difficult metropolitan district and in New England. Mr. Boales enlisted for active service with the colors in the fall of 1917 and won a commission as second lieutenant. He was honorably discharged January 27. As assistant to Mr. Boales, the company has appointed C. W. Adams, who has also been in military service and who was previously general manager of branches for the Spencer Heater Company. Mr. Adams is a Massachusetts "Tech" man and has been conntected with the heating industry for the past fifteen years.

McAlear Mfg. Co., Chicago, Ill., announces the election of Robert E. Goldschmidt as vice-president of the company. Mr. Goldschmidt has assumed the duties of district sales manager for Wisconsin and upper Michigan for the sale of the MsAlear line of valves and other heating specalties. His headquarters will be in the First National Bank Building, Milwaukee, Wis.

Walworth Mfg. Co., Boston, Mass., has taken over the exclusive sale for the New England States of the Foster specialties, including the Foster pressure regulators, manfactured by the Foster Engineering Co., Newark, N. J.

DeVed-Kissick Co., Inc., Singer Building, New York, which, as announced last month, has added to its line of power plant fuel and labor-saving specialties, the vapor and vacuum heating systems of the Illinois Engineering Company for the New York territory, has placed the new department under the direct supervision of A. T. Browne, who has been active in the heating and ventilating field for the past eight years, the last three of which have been spent with the Illinois Engineering Company in the New Jersey territory, which is now incorporated with the New York office.

JOHNS-MANVILLE RADIATOR TRAP

Just a ball—that's all

OFTEN it's the smallest fitting that kicks up the most trouble. Either it's hard to connect up, or the adjustment is delicate. Or some little part keeps wearing out. And, on jobs where the margin is small, these little troubles play hob with profits.

So it will pay you to get acquainted with the Johns-Manville Radiator Trap—because it's the simplest on the market. Just three parts—body, ball and connecting union; only one moving part—the hollow ball. It regulates itself, no nice adjustments necessary, no chance of tampering. You'll find this trap a money-saver all along the line.

Supplied for straight or angle connections—right, left or bottom outlet. Pamphlet and prices on application.

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

H. W. JOHNS-MANVILLE CO.
NEW YORK CITY

10 Factories—Branches in 63 Large Cities

Warren Webster & Co., Camden, N. J., announce the opening of their Texas office at 805 Sumpter Building, Dallas, Texas, with W. B. Irwin in charge as district representative.

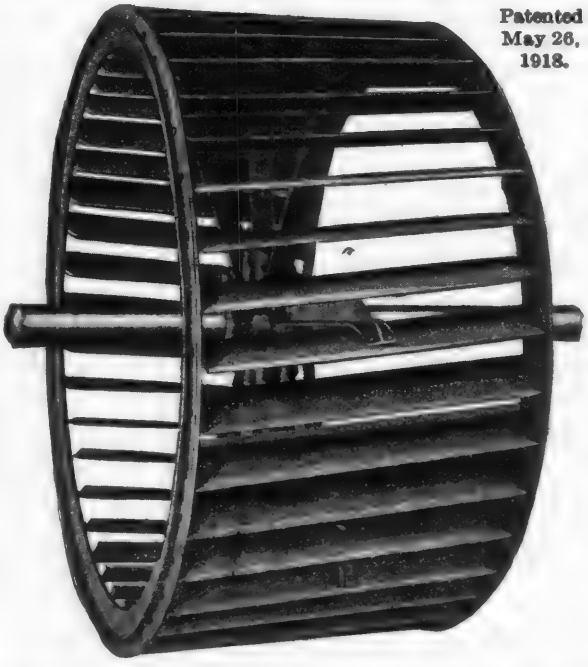
Vulcan Sheet Metal & Mfg. Co., Inc., New York, manufacturers of duct work for heating and ventilating systems, reports that it has just passed its first anniversary. The success of the company has already necessitated an increase in its capital stock. C. H. Quirk is vice-president and general manager of the company.

Kewanee Boiler Co., Kewanee, Ill., elected the following directors at its recent annual meeting January 28: E. E. Baker, B. F. Baker, J. P. Dugger, M. F. Moore, C. A. Burton, Homer Addams, C. V. Kellogg, E. F. Wagner, H. E. Pursell, H. D. Cherry and W. D. Glidden. The officers were re-elected as follows: President, E. E. Baker; vice-president and treasurer, B. F. Baker; secretary, J. P. Dugger; manager, M. F. Moore. H. E. Pursell was appointed manager of sales and W. D. Glidden, assistant treasurer. On the same evening the fifth annual dinner of the company for the branch house managers, etc., was held in Kewanee. The speakers included President Baker, Manager M. F. Moore, Secretary J. P. Dugger, Homer Addams, W. K. Cochrane, writer of the company's advertising, P. M. McMichael, of Toronto, general manager of the Dominion Radiator Company, and Dan Moore, who spoke for the men in the shop.

Ilg Electric Ventilating Co., Chicago, Ill., has purchased the vacant property at the southwest corner of Crawford Avenue and George Street, Chicago, 325 x 1333 ft., on which it is proposed to build a new plant for the manufacture of the Ilg line of fans, blowers and ventilating apparatus. The reported consideration for the property was $80,000. The new plant will be built in units, the first unit to cost approximately $250,000. About a year ago the company purchased a five-acre tract in the northwest part of the city with the purpose of building a new plant there, but this site was not considered large enough, so the land just acquired was purchased.

H. W. Johns-Manville Co., New York, is planning to spend $3,000,000 on its new plant in Waukegan, Ill. These works will supplant those in Milwaukee which employes 1100 operatives. The Waukegan site is on the lake front and construction

A Uniform Unrestricted Flow of Air



Patented May 26, 1918.

across the entire width of the wheel means

Highest Efficiency

We do it by setting the vanes at an angle to the shaft (patented feature). Rigid and reinforced construction assures DURABILITY.

These features, coupled with "GARDEN CITY" SERVICE, should remind you of

Cycloidal Multivane

when you are interested in fans.

Catalogue containing complete data sent on request

Garden City Fan Co.

Est. 1879

CHICAGO, ILL.

Eastern Representatives:
L. J. WING MFG. CO., New York City

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Sirocco"

TRADE MARK

Speeds Up Production

In these days of rush work, with everything strained to the limit, fresh pure air for the factory is of vital importance.

The Sirocco System of Heating and Ventilating is used by many of America's best known and most successful manufacturers.

The view above shows an installation in a factory noted for its production and efficiency methods.

In the "dog days" of summer the Sirocco System is invaluable in keeping the factory workers fresh and fit by supplying the proper amount of fresh, pure air to every nook and corner.

Let us tell you more about Sirocco for your factory—Ask for Bulletin No. 270.

American Blower Company

DETROIT, MICHIGAN

BRANCHES IN ALL PRINCIPAL CITIES

is expected to begin as soon as the land is filled in. Herman J. Esser, 402 Camp Building, Milwaukee, is architect and engineer. The Milwaukee plant is in charge of Charles R. Manville, vice-president and general manager.

Jenkins Bros., New York, held its annual reunion early in February, closing with a dinner at the Hotel Astor. Lieutenant William G. LeCompte, of the New York office, who has been in active servise, first on the Mexican border and then in France, was unable to return in time for the reunion, but is expected home in March. He came through the war unscathed, to the relief and delight of his many friends who are prepared to fittingly welcome him back.

Richardson & Boynton Co., New York, elected the following officers, at a recent meeting of its board of directors: President D. R. Richardson; secretary, W. R. Eaton; treasurer and chairman of the board of directors, D. S. Richardson.

Crane Co., Chicago, announces the election of the following officers: President, R. T. Crane, Jr.; first vice-president, J. B. Berryman; vice-presidents: A. D. McGill, in charge of finances; C. A. G. Wayman, in charge of manufacturing; E. H. Raymond, in charge of sales; secretary, C. D. Little; treasurer, A. D. McGill; assistant secretary, A. S. Bell.

Hudson Boiler Mfg. Co., New York, announces the election of Howard T. Gates, president; B. F. Lane, secretary; J. M. Ellis, treasurer; and J. Jacobs, assistant treasurer.

Pierce, Butler & Pierce Mfg. Corporation, Syracuse, N. Y., held the annual meeting of the company's officers, managers and salesmen at its Eastwood plant, February 6-8. At the various conferences,

Braemer
Air Conditioning Corporation
Air Purifying—Air Cooling—Humidifying—Dehumidifying—Industrial Ventilation—High and Low Temperature Drying—Generator Coolers—Dust Removal—Reclamation.
Webster Air Washers
LAFAYETTE BLDG.
PHILADELPHIA

THE Chicago Telephone Company recently selected the Powers System of Automatic Temperature Regulation for their Franklin Office Building at Chicago. The Michigan State Telephone Company also selected it for their new Office Building at Detroit. Both of these buildings are "Powers-equipped" throughout.

In making this choice, price was *not* the determining factor. There is a sound scientific reason for their choice. Would you be interested to know that reason?

THE POWERS REGULATOR CO.
Specialists in Automatic Heat Control
954 Architects Bldg., New York
2143 Mallers Bldg., Chicago
365 The Federal St. Bldg., Boston
The Canadian Powers Regulator Co., Ltd.
Toronto, Ont.

Specify Buffalo

One of the important factors of every building about to be constructed is the heating system. Obviously to give the client the most for his money is the first consideration.

It is comparatively simple to install a heating system, but it is another matter to make it always efficient.

Buffalo Fan Systems are no higher in first cost, and their upkeep is offset by the saving in heat; the increase in efficiency of the workers.

Putting heat mechanically just where it is wanted by keeping it in circulation instead of letting it escape thru the ventilation in the roof, is the cheapest and best way.

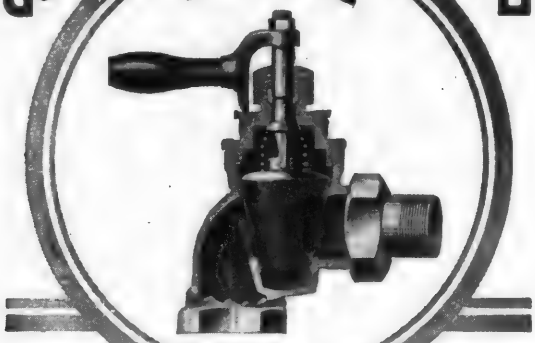
Catalog No. 198 gives valuable engineering data on heating and ventilating problems. Our engineering department is always available for consultation.

Write Dept. No. 36

BUFFALO FORGE CO.

BUFFALO. N. Y.

GORTON QUICK VALVE OPENING



Would you use a door knob that required five or six turns of the wrist to open a door?

Then why use a valve that requires nine or ten turns of the wrist to operate?

A quarter turn of the wrist opens or closes the Gorton Valve.

This makes it easy to operate the valve and radiators will then be shut off when heat is not required, and that means

Saving Coal

It is a valve that is made tight and stays tight.

Write for Catalogue telling how it is done.

See SWEET'S CATALOGUE for Specifications

GORTON & LIDGERWOOD CO.

100 Liberty Street

New York, N. Y.

in addition to the selling and administrative forces, there were present various factory committees representing the 800 employees of the Eastwood plant. It was stated that this feature is in line with the progressive policy of the company to recognize in a definite manner the importance it attaches to every part of its organization and the confidence it has in the workers in every department of the industry. Dr. J. T. Duryea, president of the corporation, presided at the opening session and made an address, defining the policies of the company in connection with labor, capital and management.

Schaefer & Bundenberg Mfg., Booklyn, N. Y., manufacturers, of indicating and recording instruments, announces the establishment of a new branch office at Tulsa, Okla., where a full line of the company's instruments will be carried, particularly those used in the defining industry. T. C. Eales has been appointed local manager for the Tulsa branch. In addition to this branch, the company has direct branches in Chicago, Pittsburgh, Detroit, Philadelphia and San Francisco, with sales agencies in Toronto, Ont., Milton & Prentiss; Greenville, S. C., L. W. Cuddy; Salt Lake City, F. C. Richmond Machinery Co.; Los Angeles, Adolf Frese Optical Co.; and Seattle, Steam Supply & Rubber Co.

Central Station Heating Notes.

Alexandria, Minn.—The city council has taken the first steps towards acquiring the interests of the Alexandria Heating Company, by providing for an election on the question of buying those interests. The election will be held in March. The purchase price stipulated is $27,294, which is the actual cost of the heating plant. The company believes it has a paying proposition, but on account of the relationship of the company to the city light and water plant, the stockholders are willing to sell.

BI-CAL-KY Ventilators

No power bills with this fan. The air that passes over your building furnishes the power to ventilate it.

We Guarantee Results

Write for information

BICALKY FAN CO.
Buffalo, N. Y.

Sturtevant Sturtevant Sturtevant Sturtevant

ANNOUNCEMENT

Honorablv Discharged

DURING the past few months 90% of the productive resources of the B. F. Sturtevant Company have been serving the United States Government, so that it has been impossible to serve any of our friends unless they were engaged in War Work.

This condition has worked hardships on all of us, and we know some were compelled to purchase apparatus not in harmony with their desires or judgment. But—that is now past. We have, figuratively speaking, been "mustered out" of the service of the government, and we stand at attention to be mustered into the service of the building and constructing army, and our ensign bears the name Sturtevant

We have learned two things during the war:—First; that Sturtevant Fans, Blowers, Engines, Turbines, and Power Apparatus met every demand made of them, just as they have been doing for sixty years. Second; we are prepared as never before to meet the needs of our friends with promptness. Our Engineering Staff will serve you promptly and efficiently, and our Works will back them up.

B. F. STURTEVANT CO.

BOSTON, MASS., U. S. A.

And all Principal Cities

Sturtevant Sturtevant Sturtevant Sturtevant

Spokane, Wash.—The Spokane Heat, Light and Power Co. has been asked to build an extension of its service to Browne's addition. The company has promised to survey the field at an early date. At present the mains only run to the city library.

Peoria, Ill.—Marked discrepancies in the valuation placed upon the local plant of the Central Illinois Public Service Company developed at the hearing before Examiner Hugh Hunter of the Illinois Public Utilities Commission. Mr. Hunter was investigating the justice of the corporation's appeal for permission to increase its rates for heat in Paris. The corporation, it appeared, values its property, where the heat plant is located, at $10,000. Other estimates made by outsiders, placed the valuation at $2000 as the outside figure, the estimates ranging down to $1200. Other points brought out at the hearing were that there was no record to show that the company had ever paid the city for a share of the cost of paving streets on which its mains are laid, and that at every point where representatives of the local gas company had had occasion to come in contact with the heat mains, they had found the insulation in a rotted condition. P. C. Parker, engineer for the heating company, testified that the radiation installed in the houses was seldom sufficient to furnish the necessary amount of heat, although this statement was taken exception to by Mr. Bennet, engaged as a heating expert to make an independent investigation.

Davenport, Ia.—Davenport is experiencing a fuel conservation campaign similar to those of last winter when eastern Iowa was facing a coal famine. The present movement has been inaugurated by the engineering department of Ames College. Representatives from the college, co-operating with the business men and heads of manufacturing plants in the city, began their investigation January 20. The plan is to ascertain if the boilers are being operated to the best advantage and to point out to the owners faulty construction or methods of operation. Lectures showing how to save coal are also on the programme for the benefit of the firemen, as well as owners of heating plants. Attention will be given to warm air heating systems in private houses. The local board of education is co-operating with the Commercial Club and business institutions in conducting the investigation. The expense will be divided pro rata among the business firms and corporations.

PRESSWELD RADIATION

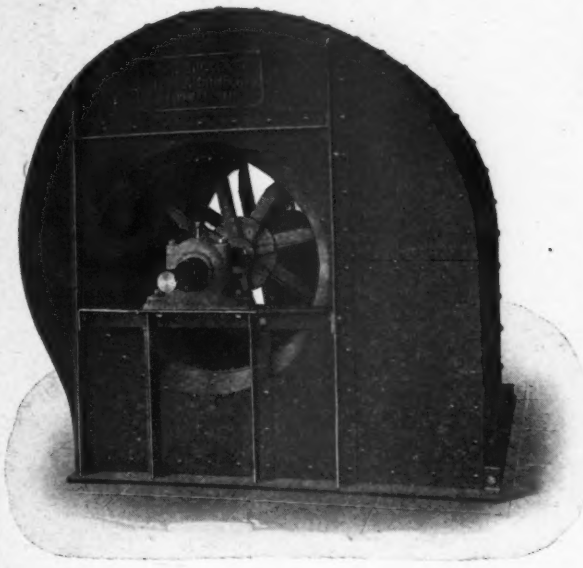
TRADE MARK

Write Dept. "D" for calalog today

THE FACT that *Pressweld Radiation* shows a vast saving in fuel (heating and cooling remarkably fast)—that it can be installed in out-of-the-way places—is much more cleanly and sanitary—yet costs no more than the old style cast iron radiator—is why so many installations are being made. The light weight—the quick handling—the low transportation charges—and many other advantages will interest you. Investigate *Pressweld*. Our catalog has some valuable pointers on modern installation work. Get your copy—*now*.

The AMERICAN PRESSWELD RADIATOR CORPORATION
DETROIT, MICHIGAN

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*



Buckeye Fans

are made for all purposes in all sizes and types.

Built strong so as to deliver full capacities under the most adverse conditions at all times.

We maintain a special engineering department for the benefit of anyone interested in heating or ventilating apparatus.

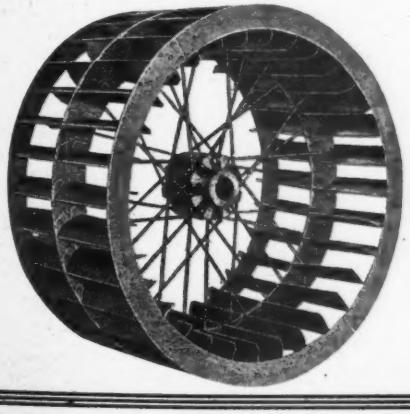
This department is at your service—FREE.

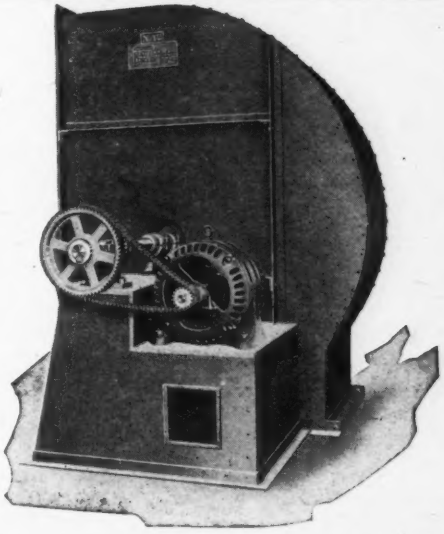
—WRITE US NOW—

BUCKEYE BLOWER COMPANY
COLUMBUS, OHIO

The Fan and the Wheel
PLEXIFORM

Maximum air delivery against low or medium-high resistance from a minimum of housing
Highest obtainable mechanical efficiency
Strength
Lightness
Quietness in operation





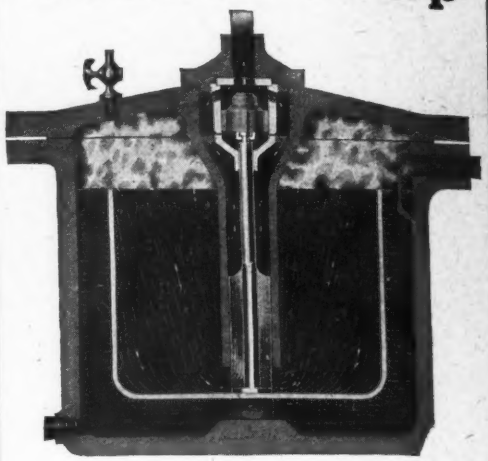
A method of construction equally adaptable to high as to low pressures and as practicable for double-width as for single-width fans.

Our Bulletin 17-V is a handbook on fan design
Sent on request

BAYLEY MFG. CO., Milwaukee, Wis.

Springfield, Ill.—Professor J. D. Hoffman, of Purdue University, was called in, in connection with the application of the Springfield Gas & Electric Company to permanently increase its rates for steam heating, to give expert testimony on the subjects of fixed charges, costs of operation of the heating and electrical departments and the proper methods of computing radiation. The company had previously testified that a waste of steam by consumers and improper installation was responsible for many of the large bills on which personal complaints were made by 70 consumers at former hearings. Among the various instances given of waste of steam were: In the case of the court house, steam turned on at all times, although the sheriff's office is the only one open at night; Gaiety Theatre building and others, lack of regulation; Unity Building, uncovered steam pipes in basement. It was estimated by D. E. Karn, heating engineer for the company, that the total hot water heating receipts for the season will be $76,972, while the estimate fixed by the State commission experts is $82,114, as the amount necessary to give a fair return. The proposed rates are between 34% and 35% higher than those previously in effect.

VANCE Steam Trap



Low Pressure Style

Extra Large Discharge Valve

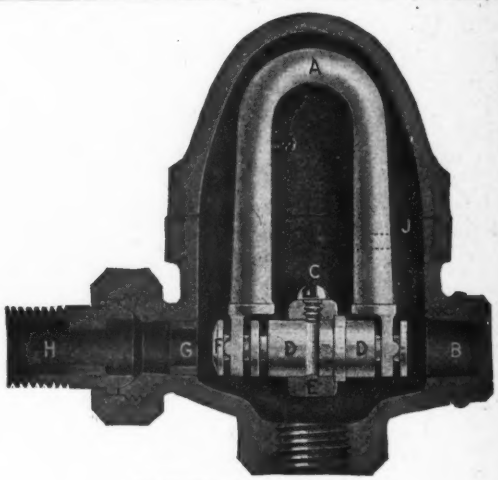
No Small Parts to Corrode and Stick

VANCE-VETTER CO., Pittsburgh, Pa.

Haines Vento
Automatic
Valves and Traps

do not depend on gravity but are operated by Nature's greatest forces, expansion and contraction.

In all cases the operating power consists of a specially designed Haines thermostatic tube mounted vertically on a horizontal valve motion.



HAINES VENTO TRAP
Recommended for use with cast iron radiation with low pressure steam. Not exceeding 10 lbs.

Guaranteed for five years and backed by 18 years of successful use.

Our Catalog explains in detail the principle of construction and operation of this valve.

WM. S. HAINES & CO., Philadelphia, Pa.

at the sign of goodheating
INTERNATIONAL
BOILERS & FURNACES

Tested and rated in accordance with the Code adopted by The American Society of Heating and Ventilating Engineers

—

SECTIONAL BOILERS

INTERNATIONAL ECONOMY

ROUND BOILERS

—

In the development of this line of boilers nothing has been taken for granted. Every detail has been rigidly tested under varying conditions of service, and each item of theoretical design has been carefully checked with actual results during a long series of tests.

These tests have been carried out in the manner prescribed by the Boiler Code and the ratings used conform strictly to the rules adopted by The Society. We allow, however, a larger reserve capacity than the code calls for.

Our catalog gives complete data. We will be glad to mail you a copy or to send a representative to talk it over with you, if you wish.

Ask for Catalog 1269-V

INTERNATIONAL HEATER CO.

MAIN OFFICE AND FACTORY

UTICA, N. Y.

NEW YORK CHICAGO NASHUA, N. H.

BRANCHES

New Firms and Business Changes.

Jaros & Baum, New York, have opened an office as consulting engineers, at 116 West 39th Street. The firm is composed of Alfred L. Jaros, Jr. and Albert L. Baum. Both men have been for a lengthy period in the technical service of the Navy Department.

Domestic Engineering Co., Inc., Minneapolis, Minn., is the title of a consolidated firm of heating and plumbing contractors, made up of G. E. Simonds & Co., C. V. O'Reilly & Co., and B. Hotchkiss. The new company's quarters are at 1304 Fourth St., S. E.

The Largest Single Heating Contract.

M. A. Dame and Son Co., Lynn, Mass., holds the distinction of being awarded the largest single heating contract ever placed. The system is that for the United States Naval Training Station, at Hampton Roads, Va., and totals approximately $1,000,000. While the contract was awarded directly by the government and does not include anything outside of the actual heating system, the work is being done under the supervision of the general contractors, John Gill & Son, Cleveland, O. About 500 men are being employed on the job. There are ten 400-H. P. high-pressure boilers in the power house. Heating equipment is being installed in 325 buildings, this part of the work requiring twenty carloads of radiation, thirty-five carloads of pipe and fittings and twelve carloads of telegraph poles. On January 31 the inside piping was completed in over 200 buildings. Clement A. Dame, general manager of the company, is in direct charge of the installation, with R. B. Crocker as general superintendent and R. T. Emery, office manager.

JONES' HEAT TRANSMISSION TABLES

Compiled by WILLIAM R. JONES

Superintendent, Department of Buildings and Grounds, University of Pennsylvania

Containing the factors given by leading authorities for all the latest types of construction

136 Different Building Materials Included

42 Complete Tables

6 in. x 9 in. Pp. 48. Printed on one side only

By Mail, postpaid, $1.00

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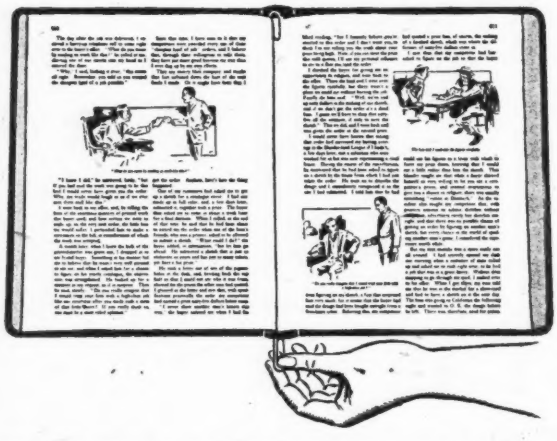

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